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The World's Leading Municipal Publication

MOTOR TRUCK TRADE

The flood of American motor trucks going to the warring nations and the greater flood of stock in old and new motor-truck manufacturing concerns actually or prospectively in operation, which is being unloaded upon the American public, make the judicious stop and ask what will happen when the war is over.

This part of the business is so spectacular that it obscures the far greater legitimate business which has been developing at the same time.

The war has conferred one benefit upon the trade because its demands have developed the possibilities of the motor truck more in two years than would have been likely in ten years of ordinary times. What war wants it must have at whatever cost, and inventive and adaptive geniuses have had their fill of opportunities to make their products meet the work required of them. Strength, flexibility, durability, have all had their capabilities tried out until the limits seem to be almost reached.

In times of peace economy has a greater influence in retarding development, and the demand must be developed equally with the supply. In times of war the demand is made and must be supplied at once.

In the countries at peace the lessons learned in adapting the motor truck to the demands of war have been applied in adapting trucks to the demands of peaceable pursuits, and the results are trucks so evidently an advance upon any former method of "retail" transportation that the home demand for trucks has grown by leaps and bounds, until the truck trade increase is even more astonishing than that in the portland cement trade some ten years since.

The trade with foreign nations is likewise increasing because there is no other place to buy trucks and because the motor truck is proving its value everywhere.

The consequence is that the war trade in trucks has become a secondary consideration, and shortly will bear as small a ratio to the total truck trade as export of munitions of war bears to our total exports. A few concerns who have specialized on business with foreign nations may have some blows when the war stops, but no others. And even here the stoppage will last but a short time, for, as Vice President M. L. Pulcher, of the Federal Motor Truck Company, well says, the devastated nations will need everything they can buy, borrow or beg to start themselves in business again, and no one knows better than they the efficiency, economy and reliability of the American motor truck.

What the American must study is the adaptation of his roads to the new traffic, already so enormous. States like New Jersey, whose early good roads were too light for this new traffic, are finding it necessary to rebuild all their main roads. Connecticut, with still lighter roads, is in still worse condition. Massachusetts and New York have been learning the same lesson with greater or less willingness. The newer states in road construction, such as Ohio and Illinois, are profiting by the experiences of their sisters and are beginning with the harder roads.

The fact is that the further development of the motor truck as an economical carrier depends upon the construction of roads suitable for the traffic, and the only limit to that development is the ability or the willingness of the taxpayers and the truck owners themselves to contribute their respective shares to the cost of these roads.

The truck manufacturer and promoter can help his industry more by pressing the construction of suitable road surfaces than by any other line of endeavor.

FIRE DEPARTMENT STATISTICS

This number is a little late in order to make the tables of statistics of fire departments as complete as possible. The table in the motor-truck section, showing the motor-truck equipment of fire departments, is particularly illuminating. Scarcely a truck listed in this long table is more than five years old, and most of them are less than half that age. Not a few departments are now completely motorized. Another demonstration that the motor truck is making good wherever it is adapted by its designers to the work to be done.

The columns showing the cost of gasoline and oil compare most favorably with the cost of maintaining teams of horses, and in the average the columns showing cost of repairs are equally favorable to motor apparatus, the occasional year when the repair bills are high being offset by the number of years in which they run low. This is emphasized in nearly every case in which comparative figures are given of the annual cost of horse-drawn and motor-driven apparatus.

STREET AND ROAD PAVEMENTS

THEIR DESIGN, CONSTRUCTION AND MAINTENANCE

EDITED BY CHARLES CARROLL BROWN, M. AM. SOC. C. E.

THE DESIGN OF STONE BLOCK PAVEMENTS

Written and Compiled by the Editor

The stone block pavement is undoubtedly the oldest type of surface laid to take the wear of traffic on footways and wheelways, with brick a good second. It is not necessary to take up here the ancient methods of laying such pavements and this article is confined to the modern developments beginning with the cobble stone street and running down to the latest attempts at making the block street surface a monolithic structure. Later articles will take up details of practical construction and maintenance.

WITHIN the memory of many now living the only pavements to be found on city streets in America were of cobble stones and stone blocks, so rough and irregular in size, shape and surface that they gave a continuous series of small shocks to traffic. These cobble stones were mainly of granitic or hard limestone substance, which had been rounded by the action of glaciers or water or both and had not yet been reduced to the size generally classed as gravel. They were selected with some relation to sizes and were placed side by side to form a surface covering over the softer material which had theretofore provided the support for traffic or had given way under it when soaked with water. Sometimes the earth base was smoothed off and compacted slightly by ramming, but more frequently a copious supply of sand was spread over the surface of the street as it had been more or less hardened by the action of water under the same traffic. This sand layer was smoothed off somewhat and then the stones were set in place in holes dug in the sand by a laying tool, one end of which served as the scoop and the other as a hammer for settling the stone into place. The stones often were oblong in shape and in such case were set on end. Sand or fine gravel was then spread over the surface to fill the spaces between the stones and the pavement was finished.

Evidently such a pavement was rough from the beginning and the roughness of the surface was soon increased by the unequal settlement of areas of the stones, so that to the rattle of the impact of the wheels on the projecting tops of the cobbles was added the swaying of the wagon when the wheels dropped into the depressed areas.

Not all sections of the country are provided with convenient deposits of suitable stone for this sort of pavement, and the use of rough granite blocks in foreign countries suggested their use in this country. The first of these blocks were exceedingly rough, the art of cutting granite being in its infancy, and the cost of dressing the blocks to any degree being too great for their use as paving stones, at least in those early days when paving of any sort was a rarity. The blocks were roughly rectangular and those from the same quarry could be split into approximately equal thickness. They were laid in the same manner as the cobble stones and on the same inadequate sort of base. Consequently, tho the surface might be slightly less rough to begin with, the unequal settlements under traffic soon put the general shape of the surface into the same condition as the cobble stone streets, and the hammering of hoofs and wheels on the unprotected and generally projecting edges of the stones soon rounded them off until the stones became practically the same as cobble stones, except that they were laid on their sides instead of on their ends.

BELGIAN BLOCK PAVEMENTS OF SMALL TRAP BLOCKS, AS LAID BETWEEN 1870 AND 1890.

When this roughness became unbearable the stones were taken up, a few yards at a time, the base was evened up somewhat and the stones were relaid, bottom up, to go thru the same process of wearing smooth and round.

These early blocks were of quite large size, early specifications requiring 10 to 15 inches length, 8 to 10 inches depth and 3½ to 4½ inches width. Granite splits readily in one direction, with less readiness in a second direction at right angles to the first and still less readily in the third direction at right angles to the other two, and the ranges of dimensions depend somewhat upon these relative qualities and upon the thickness of the lifts or layers of the mass of granite in the quarry. In the early history of the industry much of the splitting into blocks was done elsewhere than in the quarry, where the paving block business was a secondary consideration. Experience with granite cutting and the increase in demand for paving blocks under modern conditions has made it possible to devote whole quarries to the manufacture of paving blocks and to re-

duce the cost of making them at the same time that they are cut more cleanly and closely to dimensions. Demand for better cut blocks has been met and in turn has demanded better laid pavements, so that the development in the past ten years has been very rapid.

The accompanying photograph of an old trap rock block pavement on Broad street, Elizabeth, N. J., shows an early street which is in condition much better than the average of these early pavements, tho it was rough enough, according to present-day ideas, to require replacement by a modern granite pavement last year, as described by City Engineer Collins for the American Society of Municipal Improvements.

This particular pavement was laid with so-called Belgian blocks, the term applying to the size, which was introduced as a possible improvement on the large block above described. This block is 4 to 5 inches thick, 5 to 6 inches long and 6 to 8 inches deep. This form of block and the pavement laid with it are also shown in the photograph of a street laid in New York with Belgian trap blocks early in the '70's, the use of which was not abandoned until 1890.

The two kinds of blocks above described were followed by the oblong granite block shown in a third photograph, which was the standard between 1890 and 1910, but is now called the old-style pavement in R. A. MacGregor's paper before the American Society of Municipal Improvements, to which we are indebted for the cuts.

The filler for these block pavements, whether granite or trap rock, was first of sand. The wide and irregular joints made necessary some gravel to "pin" the blocks so that they would not shift under the rammer or under the roller used later to compact them into the sand cushion, and the bituminous filler was introduced to keep water out of the foundations.

Of course the quality of the foundation was improved from time to time by compacting it by ramming or rolling, by cutting out soft spots, by putting on hard material and rolling it into place, but, so long as the deep blocks were used, a concrete foundation was considered to add more to the cost of the pavement than it was worth, and so stone block pavements were not given full opportunity to demonstrate their value.

A very progressive specification of 1893 required subgrade to be formed to stakes, thoroly flooded, rammed and

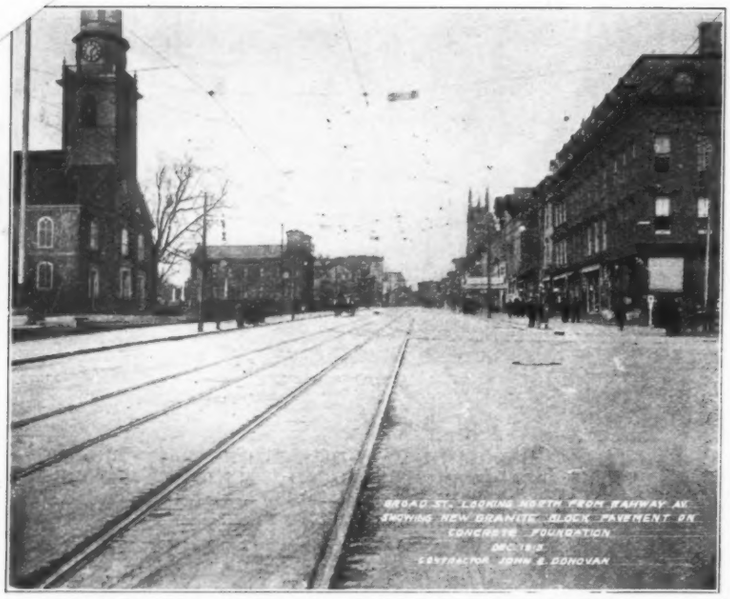
OLD BELGIAN BLOCK OF TRAP ROCK ON BROAD STREET, ELIZABETH, N. J., AS IT EXISTED BEFORE 1915, SHOWING UNEQUAL SETTLEMENT OF STREET, DUE TO INSUFFICIENT FOUNDATION.

rolled; a layer of clean broken 1-inch to 2½-inch limestone, entirely free from dust or dirt and not less than 6 inches deep, after thoro rolling; filled with limestone screenings or fine clean bank gravel below 1½ inch, flooded in and rolled with a 15-ton roller to true surface and thoro compaction, stone and gravel base together being 7 inches thick, and surface 8 to 9 inches below finished surface of pavement; 2 to 3-inch sand cushion in which stone blocks were imbedded and rammed with 75-lb. rammer of 3½-in. diameter, 2 blows to a stone, finishing with a lighter rammer to an unyielding bed and uniform surface to proper grade. Granite blocks wearing roughly were preferred to the hardest stone and hard basaltic stone taking a smooth polish under traffic was prohibited. Variation of surface of more than ½ inch was prohibited and dimensions were fixed at 3½ to 4 in. wide, 6 to 7 in. deep and 6 to 10 in. long, with even top and bottom beds. End joints were between ¼ in. and ⅝ in. and lap of 2½ in. of blocks in adjacent courses was required; clean, screened, dry roofing gravel 1/16 to ½-in. size was raked into joints before ramming, leaving ¾ in. at top of joint for a hot bituminous filler poured until the joints stayed full flush with the surface, 2½ gallons or more to be used to the square yard. This filler was of pitch, tar and creosote of fixed proportions, prepared on the spot, or No. 5 or No. 6 tar. A light gravel coat ¾ in. and less in size finished the pavement.

THE OLD-STYLE OBLONG RECTANGULAR GRANITE BLOCK, AS LAID WITHOUT CONCRETE BASE IN NEW YORK BETWEEN 1890 AND 1910.

The latest specification, adopted by the American Society of Municipal Improvements in October, 1916, differs from this mainly in requiring a concrete foundation and reducing the depths of the blocks to 4¾ to 5¼ inches, increasing the variation in width to 3½ to 4½ inches, but requiring the blocks to be selected in laying so that blocks of the same width shall be laid in a course and the joints shall not exceed ½ inch in width for an inch downward from the top nor more than 1 inch anywhere, and the top surface shall not vary more than ⅜ inch from a straight-edge applied in any direction on it. The length of blocks is made 8 to 12 inches. The essential differences in the blocks are in depth and smoothness of surfaces, and in selection of uniform widths for laying together. On account of the more uniform size of blocks the sand cushion is reduced to 1 inch thickness. Specifications for tar pitch, asphalt and cement grout fillers are presented for choice. No pinning with gravel or filling of joints with sand is permitted before the prepared filler is applied.

The fourth photograph shows the reconstructed


BROAD ST., LOOKING NORTH FROM RAILWAY AVE.
SHOWING NEW GRANITE BLOCK PAVEMENT ON
CONCRETE FOUNDATION
ENGINEER
CONTRACTOR JOHN E. DONOVAN

COMPLETED GROUTED GRANITE BLOCK STREET ON BROAD STREET, ELIZABETH, N. J., LAID ACCORDING TO THE LATEST STANDARD SPECIFICATIONS.

street of the second photograph, in which the standard specifications were followed.

In districts within reach of the sandstone quarries about Medina, N. Y., Denver, Colo., and the like, a comparatively smooth stone block pavement was developed 15 or 20 years ago, because these materials could be brought to straight, even surfaces of fracture with parallel sides and ends and right-angle joints. A specification for the pavement revised by City Engineer E. A. Fisher, of Rochester, N. Y., in 1901, provides that blocks might be 3 to 6 in. thick, 6 to 6½ in. deep, 7 to 12 in. in length, cut to lay with tight joints for 3½ in. down and a smooth, even surface, with no projection or depression of over ¼ in. These blocks were laid in courses of uniform width and depth with all longitudinal or end joints close and joints between courses not over ½ inch top and bottom. Hot dry gravel was brushed into these joints to fill them up 3 inches, the stones were rammed 3 times with an 80-lb. rammer, the joints again filled with hot, dry gravel between 1/64 and ¼-in. mesh screens, poured from a small spout and settled in place with wire picks, and then filled with paving pitch or portland cement grout as specified, the grout being applied in the manner described in the article on brick paving construction.

Excepting for the filling of the joints with gravel this specification agrees very closely with the latest standard stone block specifications described above, and indicates that the manufacturers of granite blocks have been able to prepare their more refractory material so that it can be laid in a manner which demonstrated its value for the softer materials nearly or quite 20 years ago.

The standard specification of the A. S. M. I. meets with the approval of engineers in almost every particular. The sand-cement cushion similar to that described in the article on brick pavement construction is used in Baltimore and Manhattan boro on account of the elimination of danger of shifting of the sand cushion, but it is not in general use as yet, one reason perhaps being that it adds about 16 cents a square yard to the cost of the pavement. In cities having heavy traffic the closing of a street is such a serious matter that the cement filler can not be used because it must set for several days without traffic if it is to be successful. With the small blocks described below the cement-sand cushion is very desirable.

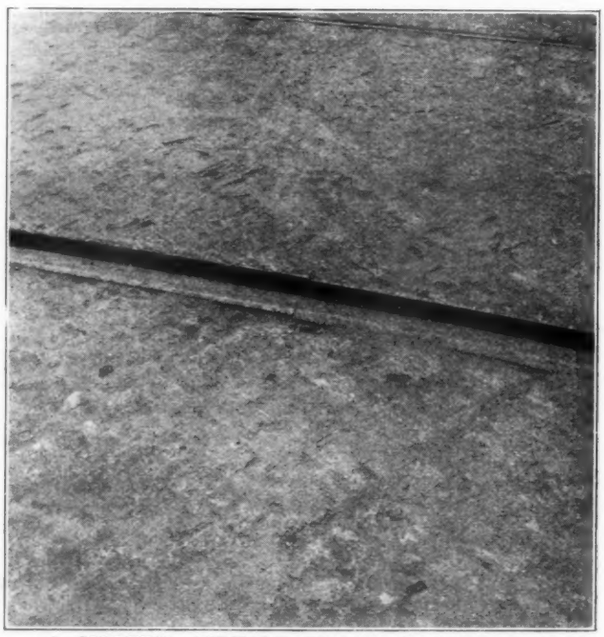
Street railway companies using granite blocks or Ligonier blocks for paving between the rails or adjacent to them often set the blocks in the green concrete and roll them down into it until an even surface is obtained, and use the cement grout filler.

If the cement filler is used on steep grades, say 4 per cent. or more, the joints should be raked out slightly before the grout takes its initial set, so as to give a foothold for horses similar to that obtained by the use of hillside brick.

Bituminous filler is most generally used in stone block pavements unless the small sizes are specified. In Baltimore the joints are filled with hot gravel and about four pourings of hot asphalt are necessary to fill the joints, and the pavement is finished by squeegeeing the filler over the entire surface of the blocks and sprinkling it with hot gravel. This coating lasts for some time and gives the appearance shown in one of the accompanying photographs, which is of a street following in all respects, except the gravel in the joints, the standard specifications.

A new filler composed of a mixture of pitch and sand in equal parts was used on Broadway, Brooklyn, N. Y., and was described in the September number of MUNICIPAL ENGINEERINR. In Alabama street, Atlanta, Ga., half the street is filled with this pitch and sand mixture and half with an asphalt and sand mixture, which will give data for a comparison in that climate. The result would not be applicable in all respects to a pavement in the colder winter climates of the northern states.

There is so much good material in a large granite block after its surface has worn beyond further use that for the last 5 years the plan has been used of splitting the blocks in smaller sizes and laying them, on a concrete foundation, as has been described in several numbers of MUNICIPAL ENGINEERING. This has led to the adoption of a shallow standard block by some engineers and quarrymen, which is 4 to 4½ inches wide on top, 4 to 4½ inches deep and 8 to 12 inches long. Some quarries now cut a still smaller block for use in



A MODERN ASPHALT FILLED GRANITE BLOCK PAVEMENT IN BALTIMORE, MD., LAID IN JULY, 1914, AND PHOTOGRAPHED IN AUGUST, 1916. NOTE ASPHALT STILL CLINGING TO SURFACE OF BLOCKS.

replacing with granite other surfaces which have worn out. This block is 3¾ to 4½ inches on top, 3½ to 4 inches deep and 7 to 11 inches long.

A still smaller block, in cubes of 2¾ to 3½ inches dimensions, has been described in MUNICIPAL ENGINEERING. It is laid in concrete and in patterns of more or less irregularity so as to prevent regularity of joint position.

The standard specifications do not yet endorse these smaller sizes of blocks except as recut from the old large blocks for lighter pavements or cut new of the size of the resurfacing blocks above noted, of which the principal difference from the standard blocks is in the depth.

The trap blocks shown in two of the accompanying photographs are not as readily squared as the granite blocks and therefore they have a more irregular appearance than a granite block street of the same general description would show.

A MODERN ELECTRIC TURBINE PUMP

THE accompanying illustration shows the electric pumping unit in the High Level station on McTavish street, Toronto, which consists of a three-stage turbine pump, built by John McDougall Caledonian Iron Works Co., Ltd., driven by a 400-h.p. motor built by Allis-Chalmers-Bullock, Ltd., and operating under full load at 620 r.p.m. on a 2-phase, 60-cycle, 2,200-volt current. This pump contains several novel features to eliminate noise and vibration, and a special thrust bearing. A test was conducted by Mr. L. A. Herdt, professor of electrical engineering at McGill University, assisted by Mr. Charles Lester.

The duration of test was 24 hours and readings were taken every 30 minutes for the first 6 hours, after which readings were taken every hour. The test was carried out to determine the discharging capacity of the pump per 24 hours and the electric power required, also the over-all efficiency and the rise of temperature of the electric motor under full-load continuous run of 12 hours, as well as the smoothness of running of the machinery.

The discharging capacity of the pump was guaranteed to be 5,000,000 Imperial gallons per 24 hours pumped against a pressure of 110 pounds per square inch. The water pumped during the first 12 hours amounted to 2,725,000 gallons, against an average pressure of 107.2 pounds per square inch; during the second 12 hours, 2,745,000 gallons, against an average pressure of 106.3 pounds, or a total of 5,470,000 Imperial gallons for the 24 hours.

The average electric horse power consumed for the first 12 hours was 421 h.p., and 421.3 h.p. for the second 12 hours. The maximum power used was 438.5 h.p. The pump was then pumping at the rate of 4,080 gallons per minute, that is, over 5.8 million gallons per 24 hours. The over-all efficiency of the pump was as follows:

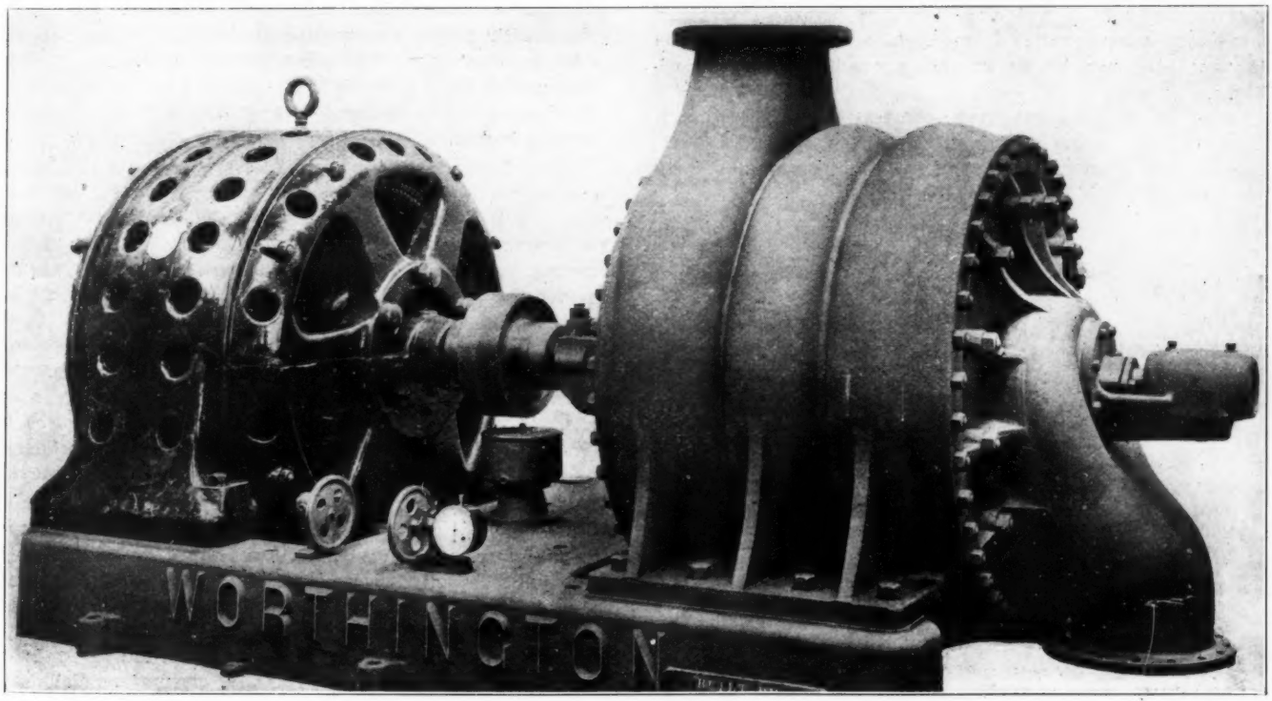
When pumping 3,500 gallons per minute, 65.00% average
When pumping 3,700 gallons per minute, 66.05% average
When pumping 4,000 gallons per minute, 67.00% average

The pump was guaranteed to show an over-all efficiency of not less than 65.00 per cent.

The rise of temperature of the electric motor above that of the surrounding air did not exceed 30 degrees centigrade; this comes well within the specifications, as a rise of 40 degrees was allowed at full load. The pump ran very well during the test with very little vibration and noise.

A noticeable feature was an increase in efficiency from 65 per cent., when running at its rated capacity of 5,000,000 gallons, to nearly 69 per cent., when running above its rating; in other words, when pumping at its most economical capacity it showed an efficiency of nearly 69 per cent. During the fire at McGill University, the city realized the advantage of this generous measure of capacity in both pump and motor. The record of the Venturi meter in the McTavish street pump house showed that when the demand for water was most pressing the pump operated at a rate exceeding 6,000,000 gallons per day, or more than 20 per cent. beyond its contract capacity.

A bonus of $10,000 was paid on this 12,000,000-gallon pump by the city of Montreal for economy over the contract guarantee.



SEGMENTAL BLOCK SEWERS

By J. F. Springer, New York.

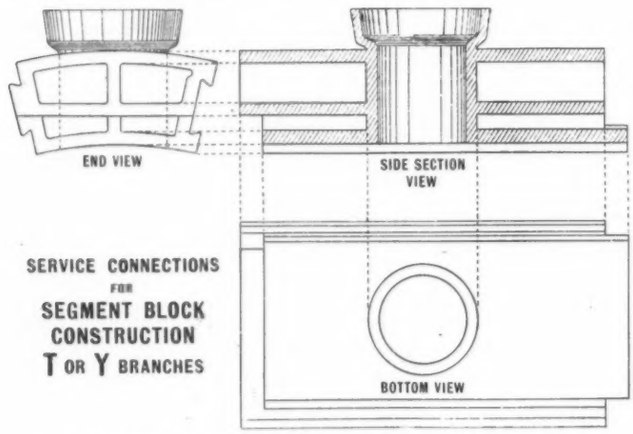
This article in the series on various materials used in sewer construction is devoted to one of the newer systems, that using segmental blocks, which differ from bricks in their size, in their material in concrete block sewers, and in the form in which that material is put up in vitrified clay block sewers.

There is a large field for this method of construction and success has been met with almost uniformly in building strong, durable and sanitary sewers and in keeping the cost within reasonable limits. As knowledge of the material and of the sewers built with it increases, the use of the system seems certain to increase.

SEGMENTAL block sewers are those constructed of blocks laid in place to form both invert and arch. Each block occupies a segment of the complete circumference or perimeter. The block is sometimes made of concrete, sometimes it is a vitrified clay product. The blocks are made and matured before being put in place. As each is of moderate size, it is possible to insure high-class manufacture, whether the material be vitrified clay or ordinary concrete. Ordinarily the blocks need not be larger than one-man size. Thus, in a patented system of concrete blocks the largest block has a weight of 180 pounds. It goes into the ring of a 48-inch sewer. More usual weights of concrete block segments range from 100 to 125 pounds. Weights of vitrified clay segments are, say, one-third of the latter or less.

A considerable advantage of the segmental block system, whether concrete or hollow tile be used, is the fact that the invert may be laid in water. Or we may lay the invert and allow water to run over it at once. In practical construction this may at times be an exceedingly advantageous possibility.

A further practical advantage consists in the fact that it will ordinarily be practicable to go ahead with the backfilling at once upon completion of the arch, or at most with a very inconsiderable delay.



I. SECTION OF AMCO SINGLE-TILE SEWER AND T-BRANCH.

The centering required for segmental block construction need be nothing more than a skeleton. This will be removable after a ring or two have been set in place. There are some special devices for centering for which advantages in handling are claimed.

Still further, in segmental block sewer construction, the difficulties of working in tunnels are reduced from what they would be with the placing of mass concrete.

Some of these advantages make for speed in construction. Some make for quality. Certain of the advantages are possessed, no doubt, by other systems. Ordinary brick sewer construction possesses some. But even here the segment block, being much larger than a brick, permits a single handling to produce the equivalent of many bricks. The reduction in joints is another advantage.

The advantages enumerated are possessed in common, tho perhaps not to precisely the same degree, by both the concrete block and the vitrified block.

The inventor of a patented concrete block claims the following additional advantages: (1) The steel reinforcement may be placed to great advantage. "The tensional regions of the intrados may be anchored against those of the extrados of the arch." (2) Minimum weight of steel required to secure effective reinforcement. With regard to the quality of the concrete the manufacture of small blocks above ground permits us to secure a high degree of imperviousness.

The vitrified block for use in segmental construction has been on the market for 5 or 6 years. Each block has partitions paralleling the axis of the sewer, which divide the hollow inside into two or more channels. When the blocks are assembled it is possible to lay the invert blocks so that a kind of sub-drain is formed by the junction of such longitudinal passages. The objection has, however, been made that when laid to secure this advantage, if advantage it be, it is difficult to make a water-tight joint where end of block joins end of block. It is said to require especial care to produce an impervious joint. The longitudinal joints are more easily made water-tight because of the increased area of surface with which the mortar is in contact and because the longitudinal joints surfaces are corrugated.

Segmental blocks of vitrified clay are made in a multitude of sizes corresponding to sewer diameters, varying from 30 to 108 inches.

The problems in laying segmental block sewers are in part the same as those encountered in laying masonry and brick sewers. There must be an adequate foundation. This will usually be afforded by the natural strata. However, it must be borne in mind that it is very necessary that the support provided be even. Hard and soft spots contribute a poor condition for vitrified pipe and concrete pipe. It will be safest to assume that such a condition will be even poorer for the barrel of a segment-block sewer, for the reason that this barrel is made of many parts and that there are many joints. If the soil does not have good supporting power we may enlarge the base of the sewer by means of a concrete invert having a flat base sufficiently wide to distribute the load.

Vitrified segmental blocks differ somewhat with different ranges of size. All ends are either formed or laid so as to break joint radially as well as longitudinally. The Amco block has an offset at one end fitting into a corresponding recess on the other end. The Natco block for the larger sizes of sewers is made in two layers so that the blocks break joint in all three directions—radially, circumferentially and

longitudinally. Corrugations or definite projections on the radial faces coming in contact, aid in making water-tight joints as well as in making the completed sewer more nearly monolithic. Because of the hollow construction we get a very stiff form along with a comparatively light weight.

For a 24-inch Amco sewer each segment will occupy 45 degrees of the circuit and will weigh per linear foot of length 23 pounds. One foot of sewer will contain 184 pounds of segment block. The mortar will add something to this. The over-all thickness of the block will be 4 inches. The effective width of the block on the face which is to be on the inside of the sewer will be 9 1/16 inches.

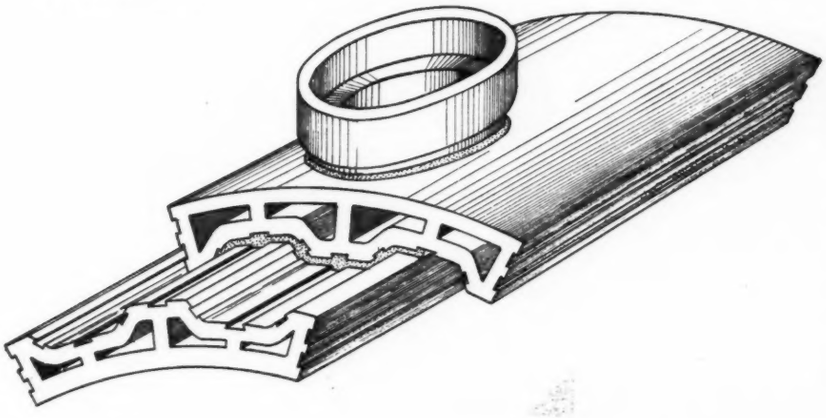
A 72-inch Amco ring will have a radial thickness of 7 7/16 inches and a weight per linear foot of pipe of 930 pounds. Twenty blocks complete the circle. The standard length of vitrified blocks for sizes from 24 to 72 inches, including both extremes, is 24 inches.

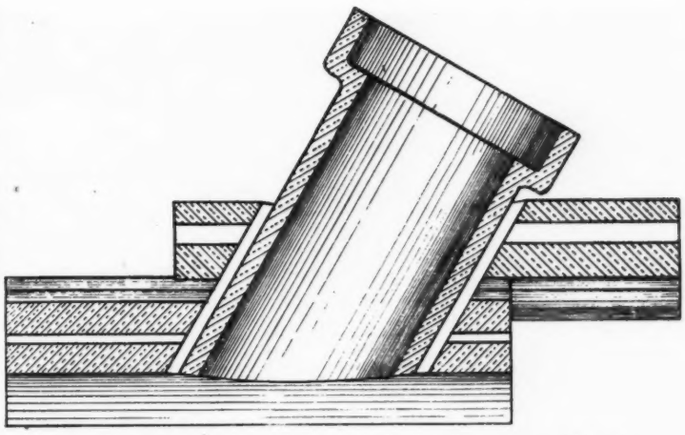
For a Natco double-tile, 72-inch-ring sewer the thickness of wall is 8 inches and the weight per linear foot of sewer is 940 pounds. Fifteen double tile are required. The standard length of blocks is 18 inches, but they are also made 2 feet in length.

With concrete blocks the number of blocks in a ring may be less than with the hollow tile segments. For example, a rather large sewer may have only 3 blocks in the half-circle of the invert. But the length of a block may be only 12 inches. A 24-inch sewer may be constructed with 4 blocks to a ring. The thickness of the concrete will be 2½ inches. The bottom block may have a flat under surface which extends 45 degrees to either side of the bottom line of the invert. We have thus a 90-degree invert without longitudinal joint. The top block will be similarly placed immediately overhead. The reinforcing rods are placed partly in the joints between blocks, where they are covered with the mortar, and partly in the body of the concrete of the top and bottom blocks. It is possible to arrange the circumferential rods in the form of an ellipse flattened top and bottom. That is to say, the rods are nearer the inner surface of the concrete tubular shell at top and bottom and nearer the exterior surface at the ends of a horizontal diameter. There is more or less breaking of joints in laying the blocks.

Fifteen hundred feet of sewer of the segmental block type were constructed in Harrisburg, Pa. This tube is 48 inches in diameter. Each block covers 90 degrees of circuit and 1 foot of sewer length. As many as 225 segments were made in 1 working day of 10 hours with a crew of 9 men. Later on the same contractors were able to turn out 250 blocks with 8 men on a job at Johnstown. Apparently, the Harrisburg

II. PERSPECTIVE OF NATCO DOUBLE-TILE SEWER AND T-BRANCH.





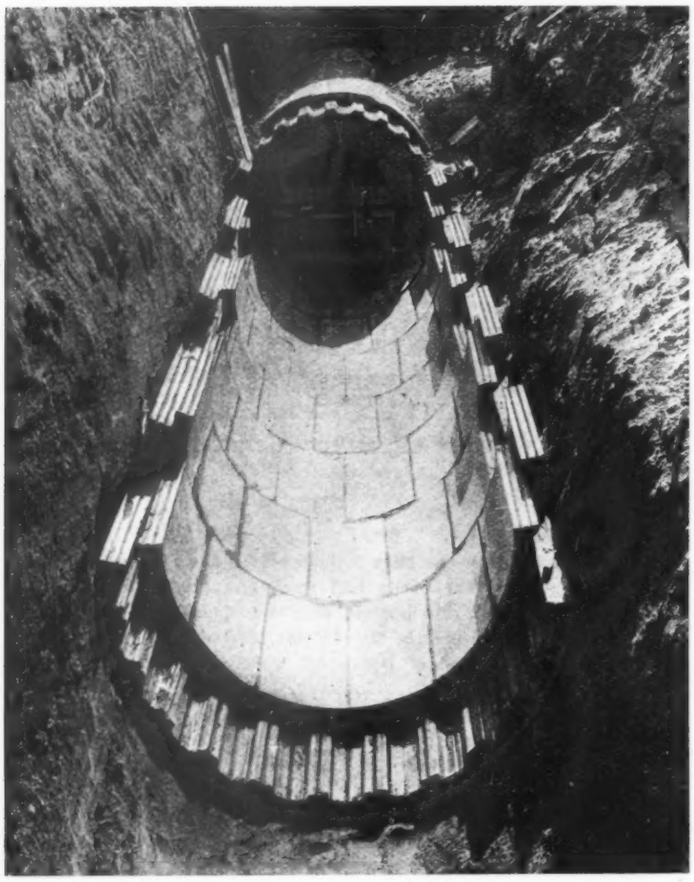
III. SECTION OF NATCO DOUBLE-TILE SEWER AND Y-BRANCH.

sewer was laid on the bare soil wherever the ground was considered good. Where the soil was thought bad two boards would be laid on the bottom and the space between and to either side of the pair of boards was leveled up with concrete. This formed a kind of bed upon which the flat side of the invert block was laid. However, tar paper 2 inches wide was interposed between bed and block at the end joint. The haunches were then filled in with concrete.

A part of this sewer is above the general surface. This is at the bottom of a partly filled gully. Here piles were placed in groups, caps put on the groups and longitudinal timbers laid. A thin stratum of concrete was placed on the timbers and the invert blocks put in place upon the bedding thus formed. The bed was completed by filling in the haunches with concrete and bringing it up to the level of the horizontal diameter. The concrete bed was made 4 inches thick at these upper points.

Concrete blocks of a different sort were used in the construction of eleven miles of sewer at Edmonton, Alberta, Canada. The sewer varied in diameter from 4 to 10½ feet. The joints in axial planes were very long for the purpose of placing longitudinal reinforcing rods. Circular reinforcing rods were used to envelop the barrel of the tube. The whole barrel with its exterior reinforcement was enveloped in concrete. All this is equivalent to a sewer of reinforced mass concrete lined with concrete blocks. The ring of reinforcement around the blocks consisted of four pieces. Two of these were rods, enveloping nearly the whole of the arch, and the other nearly the whole of the invert. At the ends of the horizontal diameters of the barrels of blocks special pieces were used to bridge the intervals between the upper and lower rods. These pieces were provided with openings or slots into which the rod ends might be passed. The rod ends were threaded and the form of the connecting pieces was such that the threads could be utilized by means of nuts to draw the ring tight against the barrel of blocks. Including rods and connecting pieces, the reinforcing ring fitted tight to the barrel, thruout nearly the total of the circuit. This arrangement provided circular reinforcement in a definite position and did not involve the complication of casting any of the blocks with reinforcement embedded.

All blocks had a standard circumferential length of 12 inches, a radial thickness of 4 inches and a length (along the sewer axis) of 12 inches. They were made of concrete in



IV. A 48-INCH SEGMENTAL BLOCK SEWER UNDER CONSTRUCTION IN WAUSAU, WIS.

accordance with the formula 1:2:3. The enveloping concrete surrounding the barrel of blocks followed the formula 1:3:6. This envelop had a minimum thickness of 4 inches. It will be understood, perhaps without my saying so, that without this envelop of protecting concrete the exterior circular reinforcement would not have been usable.

The making of connections with segment block sewers has been worked out very completely. The special block used for inserting T or Y branches in the Amco block is shown in one of the accompanying drawings. Another drawing shows a perspective of the construction of a T branch in the Natco double-tile sewer, and a third shows a section of a Y branch in a Natco double-tile sewer, and gives an excellent idea of the method of carrying the structure thru the two blocks making up the thickness of the ring.

One of the photographs shows a 48-inch sewer in Wausau, Wis., under construction with the Natco double tiles. Several interesting details are seen clearly. First, the trench has been excavated to the exact outline of the outside of the invert so that the blocks are laid directly on and beside the earth for the whole of the lower half-circle of the sewer. Second, the simple and inexpensive form used will be noted. Third, the breaking of joints longitudinally and circumferentially is evident in the finished invert. The same longitudinal breaking of joints between the outer and inner blocks is seen in the position of the blocks along the springing line, where part of the first layer of blocks in the arch has been laid preparatory to moving up the forms. The radial breaking of joints is seen in the invert in the foreground, each inner block spanning the joint between two outer blocks. The same is seen in the arch in the background.

The second photograph shows a 45-inch double-tile Natco block drain in Illinois, in which there were a number of constructive difficulties due to the irregularity of the old drainage ditch in which much of the drain was laid. The ability of the sewer to carry a heavy weight is shown by the crane following up the ditch and making the backfill. The loose earth of the fill makes this a particularly heavy test of the strength of the sewer, especially since the filling at the sides of the sewer is unusually broad and the consequent support of the sewer on haunches of invert and against the horizontal thrust of the arch at the springing line is less than is usually expected in sewer construction.

One of the strong points of the segment block sewer is the strength of the construction. In one test of a Natco single-block sewer of 36 inches inside diameter, 50 inches long and supported only on the invert, the arch being entirely uncovered, 22,040 pounds was loaded on a square 12-inch saddle resting on the center of the top of the sewer before a crack appeared. A 49-inch double-tile sewer carried 20,850 pounds without fracture under the same conditions.

While the segment block is scarcely ten years old made of concrete and is still younger as made of vitrified clay, its popularity has increased with great rapidity and the indications are that it will displace brick for sewer construction for the larger sizes to a great extent, and will successfully compete with the various methods of building concrete sewers.

(EDITOR'S NOTE.—We are indebted to the National Fireproofing Company, Pittsburgh, Pa., for most of the illustrations used in this article.)

V. A 45-INCH SEGMENTAL BLOCK DRAIN UNDER CONSTRUCTION AT GIBSON, CITY, ILL.

MUNICIPAL LIGHT and POWER PLANT

OPERATING COSTS AT MILES CITY, MONTANA

By G. C. Pruett, City Engineer.

Altho this article is almost entirely statistical it will show another successful municipal plant; successful, as the author says, because it is practically free from interference and from loading up of its force of workers with men appointed for other reasons than their competence and efficiency. Examples enough of this kind will cause public opinion to demand the same excellence of service all the time in these plants and everywhere in like plants.

THE following data from the operating records of the light and power department of Miles City, Mont., show what can be done even in a small city with municipal ownership. This plant is not different from many other plants of a corresponding size and giving service to cities of a like size and under very similar conditions.

The claim is often made, and generally speaking the claim can be substantiated, that municipal operation is not as economical as is private operation. This is a fact because of several conditions which often enter into the case.

(1) Generally speaking, municipal accounts and records are not as carefully kept as are those of private plants, and without such accounts it is difficult to detect the leaks.

(2) In many instances municipally owned utilities are made the pension bureau of the parties in power, the jobs being used to pay political debts, and an organization is maintained which is not only inefficient, but thoroly incompetent as well, and with many more employes than are necessary for the work of the utility.

(3) The governing heads, being inexperienced and unqualified to direct the operation of a utility, are often averse nevertheless to delegate the proper authority to a competent operating official, feeling that such an act would lessen them politically in the eyes of the voters. Under such conditions it is not possible to get efficient and economical results.

(4) Inadequate and improper equipment is often maintained in service long after the time when it should have been discarded and replaced with other and more modern equipment. This comes from false notions of economy.

It is the injection of these conditions, as well as many others which might be mentioned, that handicaps municipal operation and makes it more expensive and less satisfactory than private operation. When these conditions can be eliminated it is then that municipal ownership will become more popular even than it is at the present time.

Getting back again to the Miles City plant, it can be truthfully stated that the conditions mentioned do not enter to any great extent into the operation, and it is for this reason that the plant is able to make a very creditable showing in comparison with many other municipal plants. In fact, there are few private plants under like conditions which could make a better showing.

The following data are given in complete detail and cover the operation from May 1, 1915, to April 30, 1916:

I. Operating Revenues.

Commercial lighting	$58,975.90	
Municipal lighting	8,448.71	
Commercial power	9,280.96	
Municipal power	3,657.35	
Miscellaneous	1,017.22	
		$81,380.14

2. Operating Expenses.

Power plant operation and Expenses—		
Boiler room, labor	$ 5,473.41	
Fuel	22,699.11	
Supplies and expense	641.42	
		$28,813.94
Engine room, labor	$ 4,393.00	
Lubricants	560.25	
Supplies and expense	1,106.88	
		$ 6,060.13
Electrical equipment, supplies and expense		791.49
Buildings, fixtures and grounds		411.92
Total power plant operation		$36,077.48
Distribution System—Maintenance—		
Overhead lines, labor	$ 1,206.36	
Material and supplies	214.41	
		$ 1,420.77
Transformers, labor	29.00	
Supplies and expense	21.88	
		50.88
Meters, labor	240.00	
Supplies and expense	52.48	
		292.48
Total		$ 1,764.13
Operating Expenses—		
Distribution, consumers premises, labor	$ 915.35	
Supplies and expense	135.25	
		$ 1,050.60
Municipal—		
Series street lights, labor	$ 311.51	
Supplies and expense	192.82	
Cluster posts, labor	250.75	
Supplies and expense	101.65	
		$ 856.73
Collection Expense—		
Clerk hire	$ 2,148.18	
Reading meters	717.00	
Testing meters	430.00	
Inspections	193.50	
Supplies and expense	279.13	
		$ 3,767.81
Advertising		195.00
Uncollectable accounts		700.00
General Office Expense—		
Salaries	$ 2,401.75	
Supplies and expense	639.82	
		$ 3,041.57
Undistributed		$ 2,668.85
Total		$12,280.56

Depreciation and Obsolescence—

	Value	Rate	Amount Depreciated
Buildings, fixtures & grounds	$ 13,682.14	5%	$ 684.10
Power plant	19,427.58	7½%	1,457.00
Boiler plant	34,534.35	8%	2,762.65
Distribution system	47,009.01	6%	2,820.55
Street lighting system	19,924.79	6%	1,195.50
Transformers	9,571.70	10%	957.15
Meters	14,083.58	10%	1,408.35
General office equipment	2,354.62	10%	235.45
Miscellaneous	5,281.29	12%	633.70
Totals	$165,869.06	7.35%*	$12,154.45

*Average.

Contingencies—

Contingencies	$112.57

3. Summary, Revenue and Expense.

Total Revenue	$81,380.14
Total expense (incl. depreciation)	62,389.19
Net earnings	$18,990.95
Net earnings, % of total investment	11.45%

The above statement does not make any allowance for bond interest for the following reasons:

(1) The depreciation reserve places sufficient money in this fund to retire all bonds as they come due.

(2) There is at the present time very little bonded indebtedness against the plant. The original bond issues were

taken up as fast as they became due from the money in the reserve fund. Since that time all other expansions have been taken care of from the earnings of the plant.

The following classification of accounts is also of interest when studied in connection with the "Revenues";

4. COMMERCIAL LIGHTING.

Class	Number	Connected load k.w.	Annual consumption k.w.
Residences	1,079	544	220,600
Saloons	18	165	75,241
Offices	83	35	35,732
Stores	86	75	100,871
Laundries	3	10	1,684
Livery stables	8	4	1,306
Hotels	9	23	60,081
Restaurants	13	6½	31,322
Theaters	4	17½	22,691
Churches	6	6	1,189
Lodge halls	3	4	3,896
Bowling and pool rooms	4	4	12,890
Schools	7	3½	9,897
Depots	2	1	2,824
Signs	2	2	1,010
Clubs	4	6½	20,150
Miscellaneous	49	24	49,647
Totals	1,380	928	651,011

5. MUNICIPAL LIGHTING.

Class	Number	Connected load k.w.	Annual consumption k.w.
Street lighting	....	40	250,287

6. COMMERCIAL POWER.

Bakeries	2	12	870
Butcher shops	4	27	34,672
Groceries	3	10	785
Confectioners	2	3	89
Elevators, grain	1	12	4,408
Printing offices	4	16	15,472
Miscellaneous	123	280	210,813
Totals	139	360	267,109

7. MUNICIPAL POWER.

Sewer pumping plant	1	15	34,980
Water pumping plant	1	220	296,380
Totals	2	235	331,360

8. GENERAL STATISTICS.

Kw. hr. generated during year	1,684,970
Maximum load, one day (Dec. 21, 1915)	5,790
Minimum load, one day (May 16, 1915)	3,020
Maximum station demand factor	100%
Average load factor	33.75%
Average cost coal delivered, per ton	$2.15
Coal used for year, tons	10,027
Water evaporated, year (thousand lb.)	130,351
Water evaporated per kw. hr. output, lb.	77.3
Water evaporated per lb. of coal, lb.	6.5
Connected Load—	
Commercial lighting	928 kw.
Municipal lighting	40 kw.
Commercial power	360 kw.
Municipal power	235 kw.
Total	1,563 kw.
Plant Capacity—	
Boiler h.p. (standard A. S. M. E. rating)	750
Engine h.p., nominal rating	660
Electrical, kva., full load	570
Ratio, output capacity, connected load	36%
Distribution lines, miles of wire—	
Special power	8.5
Primaries, Nos. 4 to 10	35.8
Secondaries, No. 4	78.8
Street lighting, No. 6	24.2
Total miles wire	147.3
Poles, 30 ft. to 45 ft., cedar, 6 in. and 7-in. tops	1,528

Meters—

Number	Size	Number	Size
1,181	5-A	18	50-A
160	10-A	3	75-A
13	15-A	4	100-A
92	25-A		

Total number 1,471

Transformers—

8	0.6 kw.	11	4 kw.
50	1	38	5
17	1½	10	7½
17	2	13	10
12	2½	4	15
31	3	2	20

Total, 213; Capacity, 776.3 kw.

Ratio, output capacity to transformer capacity	72.5%
Costs—	
Power plant, per kw. capacity	$119.00
Complete cost of entire system, per capita (8,000)	20.75
Connected load per capita, for	
Commercial lighting	116 watts
Commercial power	45 watts
Municipal lighting	5 watts
Municipal power	30 watts
Total	196 watts

Which is on the basis of a population of 8,000.

Revenue per capita per year—	
Municipal lighting	$ 1.05
Commercial lighting	7.37
Municipal power	.46
Commercial power	1.16
Miscellaneous	.13
	$10.17
Expense per capita per year—	
Power plant	$ 4.51
Distribution	.93
Miscellaneous	.84
Depreciation	1.52
	$7.80
Power consumption per capita per year—	
Commercial lighting	81.4 kw. hr.
Municipal lighting	31.3 kw. hr.
Commercial power	33.4 kw. hr.
Municipal power	41.4 kw. hr.
Miscellaneous	23.1 kw. hr.
	210.6 kw. hr.
Cost per kw. hr.—	
Power plant	2.14c
Total, exclusive of depreciation	2.98c

9. MONTHLY RECORD STATION OUTPUT.

Month	Output kw. hr.	Month	Output kw. hr.
May	120.770	November	151,400
June	114,990	December	165,080
July	119,090	January	164,920
August	126,940	February	145,630
September	142,430	March	147,910
October	146,990	April	138,820

10. RATES.

The following schedule of rates applies to the above data:

Commercial lighting—
- First 10 kw. hr. per month — 12c per kw. hr.
- Next 40 kw. hr. per month — 10c per kw. hr.
- Next 50 kw. hr. per month — 9c per kw. hr.
- Next 200 kw. hr. per month — 8c per kw. hr.
- Next 200 kw. hr. per month — 7c per kw. hr.
- All over 500 kw. hr. per month — 6c per kw. hr.

Minimum charge, $1.10 per month.

Discounts, 10 per cent. if paid on or before the 25th of the month following the service.

Commercial power—
- First 100 kw. hr. per month — 5c per kw. hr.
- Next 100 kw. hr. per month — 4½c per kw. hr.
- Next 200 kw. hr. per month — 4c per kw. hr.
- Next 200 kw. hr. per month — 3½c per kw. hr.
- Next 200 kw. hr. per month — 3c per kw. hr.
- Next 200 kw. hr. per month — 2c per kw. hr.
- All over 1,000 kw. hr. per month — 1½c per kw. hr.

Minimum rate, 1 h.p. or less, $1.50 per month.

Minimum rate, 2 h.p. or over, $1.00 per month per h.p.

Discounts as given above.

Special rates, municipal—
- Water plant, pumping — 1c per kw. hr. (Used only during valley load except in case of fire.)
- Street lighting — 3c per kw. hr.

No discounts on special rates.

The following is the schedule of wages paid to the employes:

Engineers	50c per hour
Firemen	40½c per hour
Linemen	50c per hour
Trouble men	50c per hour
Meter readers	50c per hour
Helpers and laborers	37½c per hour

All are on an 8-hour schedule, and with the exception of engineers and firemen, are allowed time and a half for holiday and Sunday work, all get time-and-a-half for overtime.

The above data do not take into consideration any expense or revenue caused by or derived from the operation of the central steam heating plant, which was described in the July number of MUNICIPAL ENGINEERING. This plant is an adjunct of the light and power plant, intended primarily to make use of the exhaust steam, thus turning into a revenue that which is now going to waste. When this plant is in full operation it is expected that the net revenues will be increased by about $8,400 per year, and that the percentage on the present basis for plant and equipment, including the additional cost for the heating system, will be raised to 15.8 per cent. instead of 11.45, as shown by this statement.

The city is, however, at the present time installing additional equipment to the power plant, which when completed will not only add additional power to the plant, but will also cheapen the cost for operation.

These extensions, as well as the central steam heating system, were and are being paid from the revenues of the plant.

STREET CLEANING IN SAVANNAH

METHODS AND RESULTS

By E. R. Conant, Chief Engineer of Savannah, Georgia.

This account of methods and cost of street cleaning in one of the smaller cities will be of interest because few cities of this size pay proper attention to this work and Mr. Conant has given some practical instruction as to how the work can be done satisfactorily and how much it will cost. It is from a paper before the American Society of Municipal Improvements.

To be sure he does not have snow to contend with nor the freezing and thawing winter weather of our northern cities so that the figures of cost must be modified for such cities and they cannot be kept as clean in the winter season.

White labor is entirely employed in Savannah for street cleaning, but to a considerable extent the force is composed of a class which, on account of its physical condition, is unable to do an ordinary day's work; 48 per cent. employed are over 50 years of age, and 9 per cent. over 70 years of age.

The organization of street cleaning consists of one superintendent at $110.00 per month, four foremen averaging $2.50 per day, and 70 laborers, including cart and wagon drivers, at $1.75 per day.

Sheet asphalt streets are cleaned daily except Sundays with scrapers, and the scrapings placed in the gutters are promptly taken up with carts; with asphalt block and vitrified brick pavement, 40 per cent. of the area is cleaned twice a week, 40 per cent. three times a week, and 20 per cent. twice a week; with granite block, 50 per cent. is cleaned twice a week, 20 per cent. three times a week, and 30 per cent. once a week. Cobble-stone pavements are cleaned once in about ten days. The method of cleaning asphalt block, vitrified brick, and to a large extent granite block, is by horse-driven sweepers, preceded by sprinklers, all of this being done at night. Hand brooms and scrapers are used in collecting the sweepings in piles at the gutters, and these are taken up as formed by carts and wagons during the day. Cobble-stone is hand cleaned with brooms.

The material collected from the streets amounts to approximately 20,000 cubic yards per year. A large proportion of the sweepings are delivered to a local concern, which pays the city the nominal amount of $250 per annum for same. This party picks the coarser rubbish from the sweepings and mechanically grinds the refuse up and adds a certain percentage of cotton-seed meal and potash and sells the resulting mixture in Florida as fertilizer for truck farming.

The following tabulation, prepared from accurate data, gives the cost of cleaning the paved streets of the city:

Class of Pavement	Average Width in Feet, Total	Condition of Surface	Area in Sq. Yds.	Length in Miles	Cost of Cleaning per Year Including Removal of Debris	Cost per Mile per Year	Cost of Cleaning per 1,000 Sq. Yds. per Year	Cost per Cleaning 1,000 Sq. Yds. per Cleaning
Concrete	30	Good	22,000	1.25	$ 480.00	$ 322.00	$22.00	$0.204
Asphalt block.....	35	Good	329,209	12.89	7,361.00	571.00	22.36	0.205
Vitrified brick....	36	60% Good, 40% Rough	393,450	17.00	13,816.00	813.00	35.12	0.322
Granite block.....	31	Fair	116,962	5.95	4,800.00	807.00	41.04	0.415
Cobble stone.....	28	Rough	76,478	4.13	4,968.00	1,203.00	64.96	1.249
Sheet asphalt.....	40	Good	141,319	5.04	12,226.00	2,426.00	86.52	0.277
Totals			1,079,418	46.26	$43,650.00			

December, 1916

The above tabulation of cost for Savannah is only another instance as shown by other cities where correct data have been kept, where cost for street cleaning is directly proportional to the smoothness of the surface of the pavements. The tabulation shows that the cost of cleaning concrete and smooth asphalt block pavement is practically the same. The cleaning of brick is considerably higher, as the surface of worn brick pavement increases the difficulty of properly cleaning the same. The cleaning of granite block costs, per equal area, much more than the smoother types of pavement. Sheet asphalt being hand cleaned, makes the cost greater than if it was machine cleaned. The cost of cleaning cobble stone is five times as much as the cleaning of smooth pavement. Thus it will be seen that in adopting the type of pavement, the question of cost of cleaning should be considered just as much as the cost of the material required for pavement. This matter is overlooked except by those cities which have made proper study of the situation.

An efficient time-keeper is employed, whose duty, besides keeping the time of all the employes of my department, is keeping an itemized record of cost of the various branches of the work in such a manner that the unit cost of same is always ascertainable. The party employed is a technical graduate, who takes much interest in his duties, and I do not hesitate in saying that the employment of this employe saves the city many times the salary paid him.

The above covers the cleaning of the city as regards the permanently paved streets, but this city, like many others, has a portion of its streets and lanes unpaved with permanent material. An expenditure of $4,500 will be made this year in cleaning the unpaved streets and lanes, and the method followed is to go thru the unpaved streets and lanes, gathering newspapers, small quantities of building material and ashes thrown into the lanes, and to some extent shaping up the gutters.

The collection of loose paper in the business district of Savannah is, I believe, somewhat novel. The city, without cost to the merchants and others, places wooden boxes of one to two yards capacity at various localities in the lanes. By the way, this city has a regular system of lanes thruout perhaps 90 per cent. of its area. At this time there have been placed approximately 150 of these boxes, and the result of this has been a marked improvement as regards the cleanliness of the city. These boxes are emptied daily, and at this time the paper collected from the boxes is sold unbaled for $3.50 per ton.

Referring briefly to garbage collection, which, if not attended to properly, is to some extent responsible for an unsanitary condition of the city, perhaps nowhere is the collection of garbage made more regularly than in Savannah. A daily collection is made over 80 per cent. of the city—that is, in the populated section of the city—and elsewhere every other day, excepting on the outskirts, where collection is made two times a week. The normal amount collected averages 76 tons

daily. The cost of collection and delivering to the destructor plant is $2.16 per ton. In connection with garbage collection, it will be seen from the above that this city has not adopted motor apparatus or motor-driven sprinklers or sweepers.

The cost enumerated above for cleaning Savannah's streets covers and includes all labor involved, care of live stock, maintenance of equipment, purchase of all small implements and purchase of other apparatus, sweepers, carts, etc. It also includes the cost of stock, which covers the replacement of necessary live stock. The city operates and maintains its own shop for repair work, horseshoeing, building of carts and wagons and making repairs to harness, etc., and the proper proportion of shop cost is included in the cost of work noted. Interest on investment is not included, but, if added, would not increase the cost more than 1 per cent.

PUMPING STATION AND SEWAGE DISPOSAL PLANT

WARREN, R. I.

PUMP HOUSE.

PUMPING STATION.

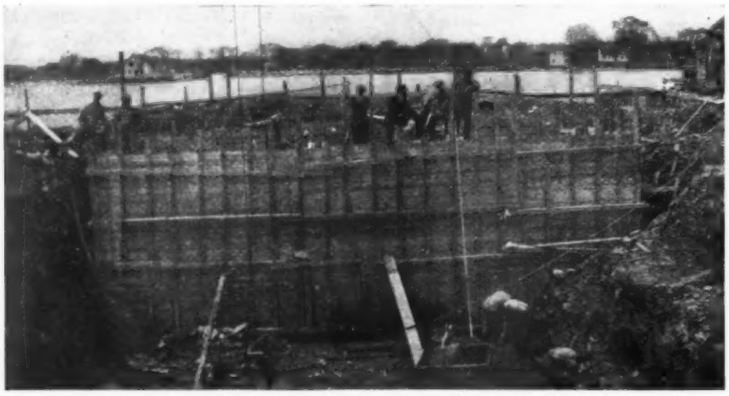
The sewage disposal plant at Warren, R. I., consists of concrete sedimentation tanks thru which the sewage passes and is then disinfected by the use of chlorine, the treated effluent finally being discharged into deep water in the Warren river. The object of the plant is to treat the sewage so that it will not be dangerous to shell fish,—the shell fish industry being an important one in Rhode Island.

The plant consists of two tanks about 50 ft. long, 15 ft. wide and 16 ft. deep, with a compartment 14 ft. wide and 38 ft. long which contains the mixing chamber, pump well and a pit in which are located two centrifugal pumps to be driven by electric motors automatically controlled by floats. The settled and treated effluent flows by gravity into the river during the low stages of the tide and is pumped out automatically during the few hours of high tide. The bottom of the disposal tanks is about 12 ft. below high tide. The bottom of a tank is 12 in. thick and the walls are from 27 in. thick at the bottom to 12 in. at the top, all being reinforced with ½-in. steel bars. The tanks are covered with a 6-in. reinforced concrete slab.

In addition to this disposal plant there are 2 small concrete pumping stations consisting of tanks 26 ft. long, 15 ft. wide and 14 ft. deep with a small building on top for motors. The bottoms of these are about 12 ft. below high tide, and they are built in wet marshy ground. The walls of the tanks are 16 in. thick, the bottoms 12 in. thick, all reinforced with ½-in. square rods. In a compartment in each of these tanks there is a duplicate set of automatically operated, motor-driven, centrifugal pumps which lift the sewage from low points in the town to the disposal plant. The concrete for all these tanks was composed of a mixture of 1 of cement, 2 of sand and 4 of broken stone with a proper proportion of Medusa waterproofing powder. The tanks are dry and free from leaks, and in every way satisfactory.

Charles F. Chase, consulting engineer of Providence, R. I., designed this system and was in charge of its construction.

The sewerage system of the town of Warren will consist of 10 to 12 miles of sewers from 8 to 18 in. in diameter and will cost about $125,000. The contract for the work was awarded to Frank A. Gammino, of Providence, R. I., who has had considerable experience in this class of work. James L. Murray as resident engineer supervised the construction of the work with the assistance of Joseph C. Estes.



WEST WALL OF DISPOSAL PLANT.

LIMITING LOADS AND SPEEDS
OF MOTOR VEHICLES

By Eugene W. Stern, Chief Engineer of Highways, Manhattan Boro, New York.

This paper, presented to the American Society of Municipal Improvements, attacks one of the most important problems now before the paving and the motor truck fields, and shows its serious nature.

Most of the questions raised by the author are answered by the report of the New Jersey committee on truck traffic regulation which is appended to it. The latter will undoubtedly result in some form of legislation this winter in New Jersey which will probably be as nearly satisfactory as possible to truck manufacturers, truck owners and operators, and highway authorities and taxpayers, since all are fully represented at the numerous hearings, and the tentative report is being modified in accordance with the results of the discussions.

DURING the past year a great deal of damage has been caused to some of the best pavements in the Boro of Manhattan, City of New York, by heavily loaded steel-tired trailers hauled by motor vehicles. The destruction has been so rapid that it has brought to the attention of the authorities the necessity for limiting the loads on vehicles to be hauled over the city streets.

In recent years there has also developed a greatly increased use of the motor vehicle, with increase in size, so that many of the streets in business sections of the city are becoming congested. Unless some limitation is placed upon the size of vehicles, this condition will continue to become worse.

As the weight and size of the vehicle increases, the question of limiting the speed also must be considered, for it becomes evident that what would be a reasonable speed for an ordinary size vehicle of moderate weight would be detrimental to the public interests in larger and heavier ones.

Damage to City Streets Caused by Vehicles.

The most damage seems to be caused by steel-tired vehicles hauled by motor trucks, or trailers as they are called.

The case in point is here given: A contractor's outfit hauling rock from the subway excavation on Broadway is made up of a tractor and trailer. The latter carries six large buckets, weighing about 15 tons. Its wheels are 41 inches in diameter with 8½-inch wide steel tires. The load per inch width of tire is about 1,400 pounds.

The springs on the front axle are spiral and on the rear, flat. They are very stiff, and this fact has unquestionably contributed towards the destructive effect of the wheel loads of the trailer. The jarring effect of the loaded vehicle is such that people along the route traveled complain about excessive vibration in their buildings.

The route traversed has been along West 42d street from 8th to 10th avenues; north on 10th avenue to 50th street; west on 50th street to the dump dock on the North river.

The age and character of pavements on the route is as follows:

Forty-second street from 8th to 9th avenues: Sheet asphalt on concrete foundation, completed July 22, 1912.

Forty-second street from 9th to 10th avenues: Improved granite on concrete foundation, completed November 14, 1912.

Tenth avenue from 42d to 50th streets: Improved granite on concrete foundation, completed February 26, 1913.

Fiftieth street from 10th to 11th avenues: Sheet asphalt on concrete foundation, completed August 27, 1912.

Fiftieth street from 11th to 12th avenues: Improved granite on concrete foundation, completed May 25, 1912.

It will thus be noted that these pavements are all substantially about four years old. They are considered among our best pavements, and have been laid in conformity with the latest specifications. Up to the time when the damage began to be done by the above mentioned trailers, no appreciable amount of wear had been noticed beyond what ordinarily might be expected on thorofares with as much traffic as have the streets above mentioned.

The mischief has all been done in a very short space of time, about nine months, and has amounted to 5,400 square yards of repairs on granite (equal to 32 per cent. of the total area), costing $6,000, and 1,900 square yards of repairs on sheet asphalt (equal to 30 per cent. of the total area), costing $1,900; whereas, prior to this time, the average cost per year of maintenance on the granite was $150, and on the sheet asphalt $70.

The accompanying photographs show the kind of damage that has been done. On granite pavements the granite blocks have been literally crushed and ground into powder. In many cases the blocks were split. The granite used has given splendid service on other streets of the city. The granite on 42d street, between 9th and 10th avenues, was quarried at North Jay, Me., and has a crushing strength of about 20,000 pounds per square inch. The granite used on 10th avenue from 42d to 50th street, was quarried at Rockport, Mass., and has a crushing strength of 25,000 pounds per square inch. The granite used on 50th street was quarried at Salisbury, N. C., and has a crushing strength of 40,000 pounds per square inch.

On the sheet asphalt, the destructive effect has been equally startling. In some places it has been ground to small bits; in other places the wearing surface has been completely broken and cracked. It shows many depressions, waves and ruts and shoves.

In many places the 6-inch concrete base has been shattered; however, in many other cases where the wearing surface has been damaged, the foundation remains intact.

The speed of these vehicles was about 6 miles per hour in the day time, and at night it was considerably higher—12 and 14 miles per hour, and even 16 at times.

Rubber-Tired Traffic Not Objectionable.

The effect of rubber-tired traffic has been carefully investigated, and practically no damage has been caused by motor vehicles in which all the wheels are covered with rubber, beyond what is reasonable, altho there are some types of heavily loaded trucks in use in the city. Our first-class pavements show practically no additional expense for maintenance beyond a reasonable amount.

The manufacturers of motor vehicles have found by experience, that about 750 pounds per inch width of tire is

about all the load the rubber tire will stand, and this load, together with the resiliency of the rubber and the adequate springs on motor vehicles which good construction demands, seem both together to be the saving features in protecting the pavements against undue wear, even under heavy loads.

The trailer, however, comes in an entirely different class. Not being rigidly connected with the vehicle having the engine of more or less delicate mechanism, it need not have the rubber tires nor the easy springs to prevent damage to the tractor, hence builders of these, who form a distinct class from the motor-vehicle manufacturers, have allowed their fancy no restrictions in the designs of the trailers, their principal object being to provide a vehicle having the greatest tonnage capacity at the least cost, without considering the destructive effect on the pavement caused by the excessive loads, narrow steel tires, small diameter of wheels, and inadequate springs.

It becomes evident, therefore, that immediate action must be taken to protect not only the pavements of the cities and the municipalities immediately surrounding the cities, but also the country highways which are liable to be exposed to such kinds of traffic, or the taxpayers will be called upon to make very heavy payments to maintain their streets and highways, altho these may have been constructed in a thoroly first-class manner and in accordance with the latest ideas.

It goes without saying that a vehicle that would break down the best kinds of city pavements in a few months, will cause much greater damage to even a first-class country highway much more rapidly.

Regulations Should Cover.

It would appear to the speaker that regulations properly framed to protect the pavements against the destructive effects of excessive loading in vehicles, should take into account the following factors:

1. That the wearing or damaging effect of wheel loads on pavements is a function of (a) the load; (b) the diameter of the wheel; (c) the width of tire; (d) whether or not the tire is of a resilient material such as rubber, or of steel; (e) the kind of springs.

2. That speed has considerable to do with the damaging effect of heavy loads.

An investigation of the laws and ordinances governing the weights and loads of vehicles, etc., adopted by eight states and 49 cities in the United States and Europe, goes to show that only a few laws have been drafted in accordance with modern conditions. It is surprising that even today in this country, certain communities require that the width of the tire should depend on the diameter of the axle, regardless of the loading; others make no distinction in the regulations between a wheel large or small in diameter, while still others treat rubber and steel-tired wheels the same.

RUBBER-TIRED TRACTOR HAULING STEEL-TIRED TRAILER WEIGHING WITH LOAD SOME FIFTEEN TONS OVER NEW YORK CITY STREETS.

Ordinances in Force.

Among the most up-to-date ordinances are the following:

Chicago, Ill.:
- Maximum weight of vehicle, 15 tons.
- Maximum load on any one axle, 12 tons.
- Maximum load on the wheel, 6 tons.
- Maximum load per inch width of tire, 1,000 pounds.
- Maximum length, 40 feet.
- Meximum width, 8 feet 6 inches.
- Speed: Compatible with safety, but not to exceed 9 miles per hour. Not to exceed 4 miles per hour when truck has defective tire which would cause injury to pavement.
- Motor trucks must have rubber tires.
- Trailers may have steel tires.

New York State:
- Meximum weight of vehicle, 14 tons.
- Maximum load on any axle, 9 tons.
- Maximum load per inch width, 800 pounds.
- Maximum width, 8 feet 4 inches, except traction engines which may have a width of 9 feet 2 inches.
- Speed: Over 4 tons, 15 miles per hour; over 6 tons, 6 miles per hour, with steel tires, 12 miles per hour with rubber tires.

State of New Jersey:
- Maximum weight of vehicle, 12½ tons.
- Maximum load per inch width of tire, 800 pounds.
- Speed: 3 tons, 12 miles per hour (iron tires); 6 tons, 8 miles per hour (iron tires), 10 miles per hour (rubber tires).

State of Pennsylvania:
- Mixamum weight of vehicle, 12 tons.
- Mixamum load on any one axle, 9 tons.
- Maximum load per inch width of tire, 750 pounds.
- Maximum width, 7 feet 6 inches; for busses in large cities, 8 feet 4 inches.

State of Massachusetts:
- Maximum weight of vehicle, 14 tons.
- Maximum load per inch width of tire, 800 pounds except for hard pavements.
- Speed: 4 tons, 15 miles per hour; 6 tons, 6 miles per hour hour (iron or steel tires), 12 miles per hour (rubber or similar tires).

Oakland, Cal.:
- Maximum weight of vehicle, 14 tons.
- Maximum load per inch width of tire, 800 pounds (except for hard pavements).
- Speed: 4 tons, 6 miles per hour (iron or steel tires), 12 miles per hour (rubber tires).

England:
- The English have much the most complete and scientific ordinances of any that the speaker has examined.
- Maximum weight of vehicle, 12 tons.
- Maximum load on any one axle, 8 tons (for trailers 4 tons).
- Maximum weight of vehicle without load, 5 tons.
- Combined weight of motor car anu trailer, 6½ tons.
- Weight on axle to be proportioned to diameter of wheel.

The load per inch width of tire (steel) shall be 840 pounds for wheels 3 feet in diameter; and an additional allowance for 9 1/3 pounds for every increase in diameter beyond 3 feet; and for wheels less than 3 feet in diameter, a deduction of 18 2/3 pounds per inch width of tire for every inch less in diameter than 3 feet.

Vehicles for military service limited as follows:

Weight of car unladen, 6 tons.

Weight of car with trailer, 8 tons.

Unit of registered axle weight with tires shod with cross bars, 560 pounds.

Maximum width, 90 inches for 3 tons; 90 inches for trailers.

Speed: Dependent on axle weight for iron tired vehicles, 6 tons, 12 miles per hour for rubber tires; over 6 tons 8 miles per hour for rubber tires.

Should car unladen weigh more than 3 tons, speed is limited to 8 miles per hour.

If motor draws trailer, maximum speed is 5 miles per hour.

Width of Vehicles.

Unless some limitation is placed upon the size of vehicles, the tendency will be to make them larger and larger, until they will become a nuisance and congest the highways. This is now becoming evident in the city of New York, as well as in other cities.

In order to provide reasonable standing room on each side of a street and at the same time allow traffic to proceed in both directions, we are forced to limit the width which vehicles take up.

Many of our streets have roadways only 30 feet between curbs. It thus becomes evident that vehicles over 7 feet in width do not allow for two to pass, even using the utmost care. While it is becoming necessary to widen roadways in this boro, it is very difficult to add more than 2 feet to each side; a 30-foot roadway is thus converted into a 34-foot roadway. In this case, a 7½-foot width for a vehicle would be the limit.

In conclusion, the speaker submits that this subject is one of paramount interest to all cities, and that the time has now arrived when the issues must be squarely faced.

It is hoped, therefore, that a thoro discussion of this matter will ensue, and that the result will be a crystallizing of ideas on this most important subject.

Memoranda Regarding Dimensions, Weight, etc., of Trucks used on the Subway Construction Work to haul Rock from Shafts at 39th, 41st and 43rd Streets, New York, N. Y.

Trailer: Platform over all, 22.2 feet x 8.6 feet.

Wheel Base: 11.5 feet.

Tread Base: 6.55 feet.

Length over all, including tractor and trailer, 33 feet.

Rear wheels of trailer—41 inches diameter, 8½ inches wide steel tires.

Rear wheels on tractor—32 inches diameter, with double 6-inch rubber tires.

Axle of trailer—2¾x5½ inches deep.

Rear springs, flat—53 inches long, having 20 leaves ½ inch thick x 3 1/2 inches.

The trucks carry six skips, which, when loaded with stone, weigh from 2½ to 3 tons each.

There are ten of these trucks in operation. They work 16 hours per day and each make about one round trip every hour. The total number of trips, therefore, for the ten vehicles is 160 per day.

Memoranda Regarding Granite Pavement Repairs.

Location Quarry. Crushing Strength

42nd Street, 9th to 10th Ave., North Jay, Me..20,000 lbs. sq. in.

EFFECTS OF NINE-MONTHS USE OF A DOZEN OF THE TRUCKS AND TRAILERS SHOWN IN ANOTHER PHOTOGRAPH, UPON FIRST CLASS GRANITE BLOCK STREETS ON A DEFINITE ROUTE OVER WHICH THEY TRAVELED FROM SUBWAY SHAFT TO DUMP.

Percentage of Repairs.

1915 4

9 months of 1916 .....45.

10th Ave., 42nd to 50th St., Rockport, Mass...25,000 lbs. sq. in.

Percentage of Repairs.

1915 5

9 months of 1916 .....26.

50th Street, 11th to 12th Ave., Salisbury N. C..40,000 lbs. sq. in.

Percentage of Repairs.

1915 6

9 months of 1916 .....36.

Proposed New Jersey Regulations.

In the discussion of this paper it was shown that the State of New Jersey now has under discussion a series of regulations of commercial vehicle and truck traffic which cover all of the points made in Mr. Stern's paper. The report has been prepared by a committee appointed by William L. Dill, commissioner of motor vehicles of the state, and a number of hearings have been and will be held in order to bring the report as near perfection as is possible under present conditions.

The principal points in the report may be summarized as follows, the word "truck" standing in this summary for the words "commercial vehicle or truck."

Maximum dimensions of trucks are 96 in. width if weighing more than 4,000 lbs.; 12 ft. 2 in. height; 23 ft. 6 in. length. Counties having bridges with less than 12 ft. 6 in. headroom must post them, showing clearance. Special permits as to width may be issued where weight is not a material factor of the load. Red flags must be carried if the load extends outside the dimensions of the truck.

No metal of wheels, whether tires, lugs, bobs or other sharp devices can be permitted to touch the road, except chains used in accordance with the motor-vehicle act.

Only one trailer is permitted and it must be equipped with rubber tires.

Special permits must be obtained to use trucks as pleasure vehicles.

Trucks with under-sized tires cannot be licensed.

Schedules of weights allowed on wheels, according to diameters of wheels, sizes of tires and speeds in miles per hour are provided. One-third the total weight of truck and ca-

pacity is the weight assumed for each rear wheel, which must accord with the schedule. The front wheels must accord with the schedule for single tires with the weight remaining for them to carry. Each truck must have a sealed governor with its speed regulated according to the schedule.

The statement was made that the carrying capacity of trucks in use in New Jersey now approximates the carrying capacity of its railroads, showing the importance of legislation on this subject this winter.

New Jersey and the other eastern states are having trouble with their roads of the lighter forms of construction on account of this remarkable development of motor truck transportation. Other states should profit by their experience so that their main roads will be provided with adequately paved surfaces when first improved.

The discussion indicated that the motor truck itself is not seriously troublesome except as to speed and in special cases, but that the major part of the destruction of roads adequately paved is due to the excessive weights on and improper design of trailers, and speed of the trucks whether drawing trailers or running alone.

THE GARBAGE PROBLEM

By Dr. F. E. Young, Canton, Ohio.

Garbage is the refuse of food products derived from the market, kitchen and table. Sanitary engineers calculate on half a pound a day per capita, or one ton of garbage for each four thousand population. It is estimated that one-fifth of the food bought by the average family goes into the garbage can. In the country and villages it is fed to pigs and chickens. In towns it is collected by farmers for the same purpose, but in small cities it is either dumped into the water, buried in the ground or burned. In larger cities the disposal of garbage has been one of the most perplexing and difficult problems to solve, and many methods of destruction are in use. Limits will not permit discussion or even mention of all of these, but it is coming to be a recognized fact that destruction by any method is a mistake and that disposal by reduction, with the recovery of by-products by modern methods, is always the best practice. Recent discoveries and inventions have made it practical to recover more than twice the value in by-products that is usually obtained. The alcohol is worth more than the grease and fertilizer.

Garbage Collection

The cleanest and most sanitary method of collection is to gather the full cans and dump the contents directly into the cooking tanks at the disposal works. The cans are then washed by machine, sterilized with live steam and dried before delivery to patrons. As the full cans are taken up clean ones are left for use until the next collection, when they are again taken up and clean ones left, so that patrons get a clean can at every collection.

This method avoids the use of the unsightly and unsanitary tank wagon, the escape of offensive odors and spilling of garbage while dumping the cans or driving along the street. It takes less time and labor and the cans last much longer. But the greatest advantage is that garbage deposited in the clean can does not decompose as rapidly as if placed in a dirty can from which old garbage has just been dumped. The only valid objection is that it takes more cans to serve a given number of patrons, but this is offset by the advantages mentioned. It will require just as many more cans as will be in daily transit, which for weekly collection will be about one-sixth more, or seven thousand cans for six thousand patrons.

Patrons should not put rubbish in the garbage can. Broken dishes, glass and tin cans belong in the rubbish or ash can. Bulky rags and waste papers should not go into the garbage. Dishrags and a limited amount of paper may be permitted; in fact, the housewife may save a great deal of soap and water, as well as labor, if she will wipe the greasy dishes and pans with paper before washing; for this purpose newspapers may be cut to proper size and kept in a convenient place. If the garbage is wrapped in paper, after draining off the water, it will not decompose so rapidly. As little water as possible should go into the garbage can.

The cost of garbage collection may be paid by the city direct, or collected in whole or in part from the patrons. Probably the best way is to charge a small annual fee for the service, say a dollar a year. Much of this will come from non-taxpayers and all of it from those receiving the service; the city to furnish the cans and keep them clean, collect and dispose of the garbage. The city can buy the cans, keep them clean and in repair, in quantity, much cheaper than patrons can. Cans rust thru at the bottom, and new bottoms can be put on, making them nearly as good as new. The cans should all be of the same shape and size in order to facilitate handling and cleaning. This plan divides the expense nicely and secures greater co-operation on the part of patrons than if the city pays the entire expense. It also furnishes a good means of enforcing the rules regarding the use of the garbage can. When they have paid for the garbage service and know that they will forfeit it and the money they have paid, if they do not keep the can covered or put forbidden things in it, they will be more careful regarding its use.

In order to avoid disputes and controversy the garbage service year should start at a certain date, say the 1st of April. Patrons making application during that month will pay one dollar in advance for the year. Those making application later will pay ten cents a month for each month until the next April, including the month in which the application is made. All old patrons will then pay in April for the next year. If they fail to pay or violate the rules in regard to the garbage can, they forfeit the service and must make application and pay the same as a new patron.

Rules should be formulated and patrons furnished a printed copy when they make application for the service. In fact, the rules should be printed on the receipt given for the money paid for the service. In case of violation of the rules warning should be given that upon further violation the collector will leave no can and the service will be forfeited, together with whatever money they have paid for the balance of the year.

In case of long haul, loads can be quickly transferred from collecting wagons to motor truck, or if cleaning facilities be provided at the loading stations, the garbage may be dumped into tank trucks, cars or boat for transportation to the disposal plant. It is better for large cities to have a number of units than one large central reduction works, with the necessary long transportation.

By this method of collection the odors are confined and by the anaerobic reduction process they are condensed so that there is not the nuisance created that there is by other methods of collection and reduction, besides the by-products are more valuable.

FIRE DEPARTMENT

South Bend Hoosier Pump Tests

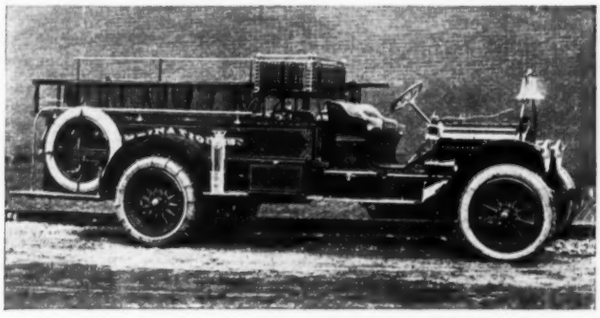
An interesting test of the Hoosier pump was recently made by the South Bend Motor Car Works, South Bend, Ind., Mr. A. C. Mecklenburg, president of the company, conducting the experiments with the assistance of the engineering department. The Hoosier pump has a 95-h.p., 4-cylinder motor, carrying 1,000 feet of standard 2½-in. fire hose and a 40-gal. chemical tank of either the Champion or Halloway type. Among other features it has a geared rotary fire pump, two 4½-in. suction inlets, two 2½-in. quick-closing delivering gates and two 9-ft. lengths of 4½-in. hard suction coupling with a strainer attachment. The tests were as follows:

Test No. 1—Two 2½-in. 300-ft. lines Siamese to 1⅜-in. nozzle, 60 lbs. at nozzle; capacity, 600 gal. per min.

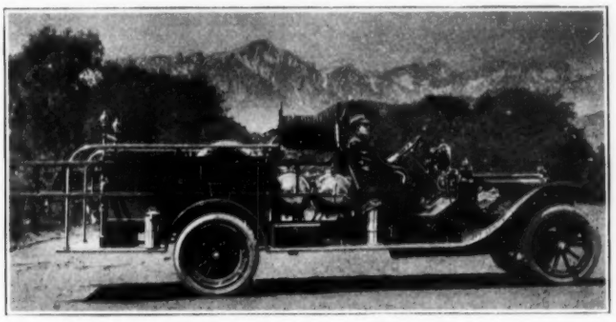
Test No. 2—One 300-ft. line, 2⅜-in., 1-in. nozzle tip, 70 lbs. at nozzle; one 300-ft. line, 2½-in., 1-in. nozzle tip, 100 lbs. at nozzle; capacity, 465 gal. per min.

Test No. 3—One 300-ft. line, 2½-in., 1-in. nozzle tip, 80 lbs. at nozzle; one 300-ft. line, 2½-in., 1⅛-in. nozzle tip, 68 lbs. at nozzle; capacity, 560 gal. per min.

Test No. 4—One 300-ft. 2⅜-in. line, 1⅛-in. nozzle, 63 lbs. at the nozzle; one 300-ft. 2½-in. line, 1⅛-in. nozzle, 65 lbs. at the nozzle; capacity, 500 gal. per min. All above tests were made on a basis of one hour each, and the company states that the Hoosier pump has a rated capacity of 250 gal. per min.



WHITE COMBINATION HOSE AND CHEMICAL, AS OPERATED BY THE CITY OF MALDEN, MASS.

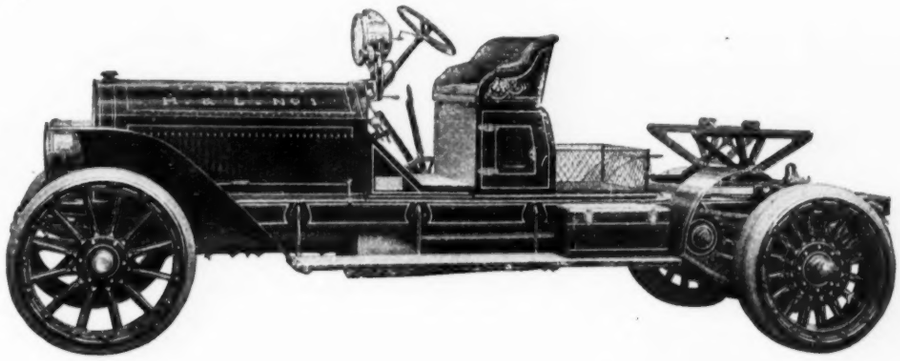


WHITE 5-TON CHEMICAL COMBINATION, AS OPERATED BY THE CITY OF GOLDFIELD, NEV.

Huntington Department Motorizing

Chief Edwin Beard, of the fire department of the city of Huntington, Ind., states that his local equipment consists of one combination hose and chemical, carrying ladders; one hook-and-ladder wagon and two horse-drawn pumpers. His fire limits include about one-third of the city, which has a population of about 15,000.

The Board of Public Safety, which constitutes the local fire committee, only recently issued bonds for $24,000 for a new central station and motor apparatus. It is intended to invest in motor-driven triple combination trucks.

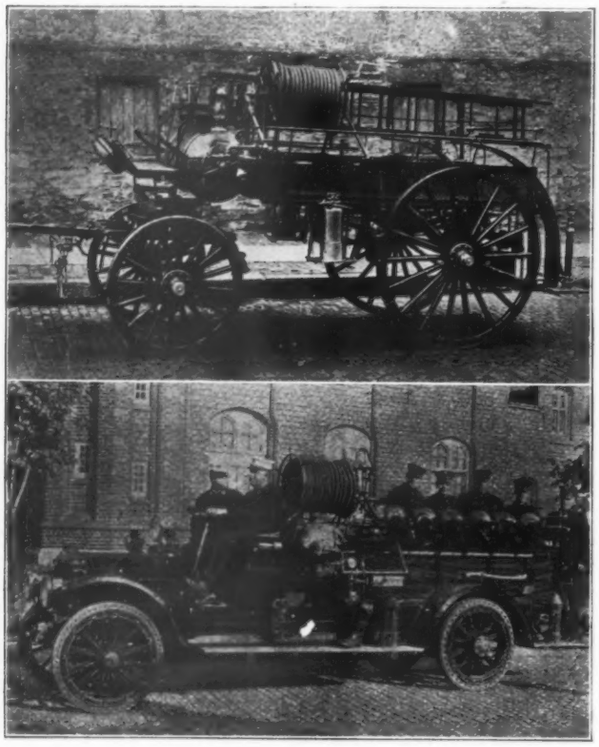


AMERICAN-LA FRANCE TRACTOR, AS OPERATED BY MANY MUNICIPALITIES IN THE MOTORIZATION OF HORSE-DRAWN EQUIPMENT.

How Albany Saved Money

Herewith appear before-and-after photographs showing increased efficiency secured at a merely nominal cost and in a way which should be interesting to every large or small municipality still using horse-drawn fire equipment.

The pictures show how the city of Albany, N. Y., adapted an old combination hose and chemical truck to a newly purchased Federal chassis, giving them a speedier, more reliable, 100 per cent. machine, adequate to modern fire-fighting requirements. Only slight and inexpensive changes were necessary to make the old bodies conform closely to the new motor truck chassis.



It is estimated that this practical adaptation of horse-drawn equipment gave the city of Albany the benefit and economy of motor apparatus that otherwise would possibly have been financially beyond their reach, or at best would have cost them from two to three times as much.

Their other horse-drawn apparatus is being similarly "Federalized."

Fire Department Notes

COTE OF WOONSOCKET

Augustin J. Cote has been chief of the Woonsocket, R. I., fire department since January, 1908. At the time of his taking office there were only twenty permanent men in the department. During 1915 he managed to increase this number to forty-seven, and eight more were added during the current year.

The new Woonsocket station was opened as a headquarters in 1913, and that same year a chief's car, a combination hose and chemical, and a 75-foot Seagrave aerial ladder, with a Christie tractor, were installed. Two additional combination hose and chemicals were added early in 1915.

BRIGHTBILL OF ELKINS

Max H. Brightbill, present chief of the city of Elkins, W. Va., fire department, stands high in the esteem of his community. When the first volunteer fire company was organized in January, 1901, he was elected president, four months later being appointed fire chief by the common council—a position which he has held thruout the ensuing fifteen years.

It is noteworthy that Chief Brightbill himself invented the fire alarm system now used by the city of Elkins. In his time the local department has progressed from hand reel to horse-drawn equipment, and from that to motor-driven apparatus.

STICKNEY, OF VIRGINIA, MINN.

Virginia, Minn., is mentioned in the official reports as one of the cleanest and best constructed cities of its size in the state, for which due credit must be given Fire Chief James Stickney, on whose horizon few "fire traps" have remained for long.

Chief Stickney joined the local volunteer department in 1904 and two years later was appointed assistant chief. The following year the department was put upon a regular paid basis, with a staff of five men and one horse-drawn wagon.

The fire station was built in 1908, and within the next three years three more men were taken on, and three new pieces of horse-drawn equipment and one Waterous motor-driven combination chemical were installed. Mr. Stickney was made chief in 1912, and since then the department has been strengthened by the purchase of a Haynes chief's car, an American-La France combination hose and chemical apparatus, seven more men, and an extensive addition to the headquarters fire station.

MICHAEL OF HANOVER, PA.

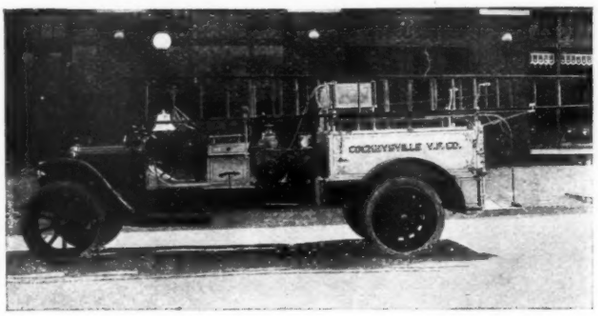
Fire Chief A. R. Michael, of the city of Hanover, Pa., owes his original election and continuance for his four consecutive terms in office to ability and popularity with the men serving under him and the subsequent ratification of their choice by the burgess and city council.

Numerous radical improvements have been effected in the local department under his administration, among them being a strictly up-to-date Gamewell fire alarm telegraph system, twenty-four large size fire hydrants, new hose and general equipment, an American-La France motor-driven triple combination apparatus and the new $12,000 fire station, which Hanoverians say gives their city one of the best equipped fire departments of any 9,000-inhabitant community in the state.

BARBER OF DOTHAN

C. J. Barber, chief of the city of Dothan's (Ala.) fire department, has spent seventeen years in battling the flames. He early joined a volunteer department in Columbus, Ga., his native town, and assumed charge of the Dothan, Ala., paid department in January, 1915.

At the time of his appointment to Dothan, the city had no law for building inspection or civic regulations as to storage of oil, gasoline, explosives, motion picture shows, etc. Along with his efficient work in putting the department upon an efficient basis, Chief Barber also put forward vigorous efforts towards adequate protective legislation, and the agitation which he thus fathered today has won for Dothan all that could be wished.



WHITE COMBINATION HOSE AND CHEMICAL, AS OPERATED BY THE CITY OF COCKEYSVILLE, MD.

Statistics of Fire Departments

A—Total for machines of the class. BD—Business district. D—Direct pressure. E—Each machine. F—Streets in fair condition. G—Streets in good condition. R—Reservoir. S—Standpipe.

This table of statistics should be considered with the tables given in the special MOTOR TRUCKS insert to obtain the full information about the departments. This table gives the general statistics of the departments and the names of fire chiefs and members of fire committees. The large table in the MOTOR TRUCKS insert gives full information about the motor-driven apparatus in use, more particularly the motor apparatus installed within the last five years. In the same section will be found a list of the proposed additions of motor apparatus to departments during 1917, which shows that there is plenty of improvement in progress, altho the number of departments which report themselves completely motorized is rapidly increasing. One or two figure references in the column headed "Condition of Streets" are to notes which will be found at the head of the table in the MOTOR TRUCKS section.

City	Pop.	Area Sq. Mi.	Area Fire Limits Sq.m	Mi. Streets	Mi. Paved Streets	Condition of Streets	Water Service	No. Fire Houses	No. Full-time Men	Name of Chief	Members of Fire Committee, Chairman Named First
Alabama—											
Birmingham	.....	....	....	....	....	...	...	..	....	S. A. Middleton, Chf.	
Mobile	57,244	18	18	....	74	...	R	11	63	C. S. McCosker.	Comr. Laz. Schwarz.
Arizona—											
Phoenix	25,000	4.35	0.49	91.28	10.25	G	D	3	24	A. F. Wright.	Robt. A. Craig, Cy. Mgr.; Peter Corpstein, Mayor; Frank Woods, Geo. McBean, J. A. Jones, C. H. Dunlap, Comrs.
Arkansas—											
Ft. Smith	32,000	13.5	¼	187	94	G	SR	4	28	M. J. Brun.	D. F. Singleton, Comr.
Helena	17,000	4	3	30	5	F	D	2	9	L. A. Moorman.	J. B. Coonly, F. E. Ruen.
California—											
Alameda	31,000	23.0	0.2	70	54	G	D	5	24	W. T. Steinmetz.	John H. Walker, E. J. Probst, John Wilkens.
Alhambra	10,000	6.0	0.2	76	69	G	R	3	6	Frank L. Hilton.	Geo. L. Yelland, Com. Pub. Saf.
Bakersfield	20,000	12.0	....	156	50	G	D	4	23	H. R. Shaffint.	W. Morgan, Cy. Mgr.
Berkeley	65,000	10.0	2.0	170	150	F	...	9	74	G. Sydney Rose.	C. Hoff.
Long Beach	40,000	13½	13½	....	....	...	...	4	35	G. C. Craw.	
Los Angeles	600,000	338	....	....	....	GFB	R	43	650	A. J. Eley.	Mayor, F. T. Wordman; A. F. Frankenstein, J. P. Yates.
Oakland	250,000	58	2	527	36	G	R	22	202	Elliott Whitehead.	F. F. Jackson, Comr. P. S.
Pasadena	47,000	13	1	160	135	G	RD	5	50	A. M. Clifford.	W. B. Loughery.
Petaluma	8,000	3.0	1.0	55	20	G	D	3	4	R. S. Adams.	M. O. Torr, G. B. Rodd, O. Cline, E. Sabrance.
Redlands	12,000	16.5	2.0	200	33	G	R	1	3	Ed. Mosbaugh.	E. J. Underwood, A. E. Carter.
Riverside	19,000	40	....	....	112	G	R	2	9	Joseph Schneider.	J. R. Williams, Comr. P. S.
Santa Ana	15,000	9	0.1	132	22	G	D	1	4	W. M. Jackson.	J. W. Tubbs, W. A. Greenleaf.
Santa Cruz	12,000	9	3	110	15	F	R	5	8	R. S. Tuit.	Chas. Canfield.
Stockton	42,500	7½	2½	175	85	G	SRD	7	36	M. D. Murphy.	Mayor O. N. Ford. A. C. Dullahan, F. A. Kenyon.
Colorado—											
Boulder	12,500	4.0	0.7	17	....	F	DR	3	7	E. A. Johnson.	A. E. Chase, J. A. Hunter, T. D. Eberhart, Fred White.
Colorado Springs	33,000	8.5	0.6	125	2¼	G	G	4	36	P. D. McCartin.	Comr. Pub. Safety.
Grand Junction	8,000	1.8	0.3	18	2	...	...	1	4	J. S. Hynes.	C. E. Cherrington, H. F. Verbeck, J. A. Rankin, C. K. Holmberg, L. E. Blacksom.
Greeley	10,000	4	0.4	64	....	G	R	1	8	Floyd Preston.	Louis Baab, B. F. Woodruff, Cottingham.
Pueblo	65,000	13½	2	240	20	F	...	6	53	Sam Christy.	Knox Burton, West, Olin.
Connecticut—											
Bridgeport	150,000	....	14.6	186	100	G	D	12	169	D. E. Johnson.	J. A. Leonard. J. H. Tague, C. C. Lindquist, J. H. Cassidy.
Danbury	24,000	7	4	60	30	G	D	9	15	Peter Beckerle.	Emil Goos, H. E. Meeker, C. Judson.
Greenwich	42,000	9	....	10	2	G	R	2	16	J. M. Sullivan.	Richard Outwater, T. F. Howley.
Hartford	130,000	18	....	144	110	G	R	15	....	J. C. Morean.	H. B. Clark, Wm. McKane, D. Elsner, T. F. Garvan, John Gleason, J. McIntyre.
Middletown	13,000	2½	2½	20	14	G	...	3	8	G. S. Pett.	A. V. McDowell, H. C. F. Howell, E. L. Feree.
Naugatuck	1,600	....	....	....	....	G	R	2	3	G. W. Hoadley.	H. B. Tuttle, John Fitzgerald,
New Britain	60,000	13	1½	....	....	22	R	5	33	R. M. Dame.	E. G. Babcock, F. L. Moran, H. Steele.
Stamford	33,000	7½	6	62	7	G	R	3	36	H. W. Parker.	W. F. Joyce, W. F. Cressy, F. C. Orfinger.
Torrington	25,000	....	1¼	....	4	G	RD	1	5	E. J. Kelley.	W. A. Gleeson, E. J. Kelley, J. M. Cluxton, J. A. Woodhead.
Willimantic	14,000	....	1	30	1	F	R	3	....	T. P. Foley.	G. M. Graves, C. M. Hollbrook, W. J. Jenkens.
Delaware—											
Wilmington	.....	....	....	....	....	...	...	..	....		Geo. Taylor, Secretary.
Florida—											
Gainesville	11,000	4	4	96	60	G	SD	1	2	E. W. McCreary.	R. B. Bush, J. H. Colson, J. A. Goodwin.
Key West	18,000	2½	½	20	5	F	SD	3	14	T. E. Reedy.	D. L. Cash, B. B. Warren, A. B. Cleare.
Miami	25,000	....	....	....	....	...	D	3	30	H. R. Chase.	Casper Hefty.
W. Tampa	12,000	2½	½	70	17½	F	DS	1	10	L. L. Moan.	J. M. Rey, P. Rey, G. N. Benjamin.
Georgia—											
Americus	13,500	4.9	0.2	52	10	G	D	1	8	J. B. Parker.	I. J. Kalmon, H. O. Jones, R. H. Horton.
Athens	20,000	7.5	0.5	110	7.5	F	SD	2	19	G. W. McDonnan.	E. K. Lumpkin, Jr., J. Z. Hoke, H. R. Palmer.
Brunswick	15,000	6	4	20	14	F	SR	1	10	J. H. Harrison.	M. B. McKimon, B. F. Jones, J. Sidney Roberts.
Rome	20,000	3.4	0.2	75	5.5	F	R	4	21	J. A. Sharp.	C. S. Pruden, A. B. Arrington, E. E. Lindsey, F. B. Holbrook, J. P. Jones.
Idaho—											
Boise	25,000	2.5	0.7	110	14	F	D	4	32	C. F. Lindsay.	J. A. Davis.
Pocatello	15,000	5	1.5	....	7	F	R	2	9	A. B. Canfield.	J. W. Hopkins, Willard Green, W. S. Hudson.

City	Pop.	Area Sq. Mi.	Area Fire Limits Sq.m	Mi. Streets	Mi. Paved Streets	Condition of Streets	Water Service	No. Fire Houses	No. Full-time Men	Name of Chief	Members of Fire Committee, Chairman Named First
Illinois—											
Alton	25,000	....	....	....	....	G	SD	5	....	Wm. Feldwisch.	H. B. Herb, Joe Grosham, Moses Rubinstein.
Aurora	38,000	7	2.5	100	45	GF	SD	5	29	G. J. Rang.	P. H. Jungles, Harvey Rockmeyer, Fred Butke.
Beardstown	7,453	1.5	0.1	32	6	G	SD	2	2	Claude Miller.	E. E. Angier, Wm. Scullion, Harry Knippenberg, C. H. Davis.
Belleville	25,000	6	....	....	....	G	D	2	18	H. C. Kunz.	Henry Baumgarten, Peter Jung, Chas. Hassel.
Belvidere	8,000	2	0.2	50	14	F	D	2	8	Frank Clark.	W. L. Rairdin, J. F. Meyers, W. H. Robinson.
Bloomington	30,000	4	1	115	46	F	SD	5	34	Henry Mayer.	A. G. Ereckson, Comr.
Cairo	18,000	25	10	50	15	F	RD	2	17	Peter Lind.	Chas. Feuchter, F. D. Nellis, M. J. Holley, Dan Kelly, Mayor, Walter Wood.
Canton	12,500	....	0.3	....	12.5	F	D	1	....	C. H. Totten.	Jos. Schuler, G. C. Sandburg, H. E. Mannahan.
Centralia	10,000	....	....	....	....	F	...	1	2	Ray Hoffman.	John Hopkins.
Charleston	8,000	4	0.3	79	14	G	D	1	2	C. W. Roberts.	Palmer Stoner, Jas. Dunifer, Theo. Nickels.
Chicago Heights	20,000	2.5	0.3	43	19	...	S	2	14	M. S. Philip.	L. C. Miller, F. W. DeBolt, Elsa Miller.
Cicero	40,000	6	....	2.5	100	F	...	5	48	A. F. Hede.	J. S. Ryland, Hart Sunek, Bachman.
Decatur	41,000	....	....	....	41	G	D	4	39	G. W. Devore.	J. F. Mattes.
DeKalb	9,000	2.5	0.15	35	11	F	D	1	7	M. H. McEvoy.	W. P. Hiland, P. Seaholm, A. Nelson.
Dixon	10,000	12	....	....	8	F	D	1	5	T. B. Coffey.	J. D. Vanbibber.
E. St. Louis	80,000	14	....	....	....	F	D	7	78	M. J. Tobin.	Edw. Cunningham, G. Janner, Phil. Minuette. J. Haggerty, S. J. Fowler, A. Murphy, W. McNary, W. B. Crawford.
Edwardsville	7,500	2	0.5	30	15	G	S	1	3	C. H. Fiegenbaum.	J. J. Watson, F. W. Schulze, E. J. Horning, J. P. Borman.
Elgin	27,000	7	1½	110	23	F	SD	5	27	Wm. Haible.	C. L. Kohn, Comr. P. S.
Galesburg	25,000	9	0.2	110	34	G	RD	3	18	J. E. Cater.	J. P. Evans, J. F. Dolan, J. E. Anderson.
Granite City	17,000	25	2	126	12	F	D	1	6	Fred Stegelmeyer.	C. Schwartz, Hodges, Jerdon.
Jacksonville	18,000	16	¼	84	28	F	R	1	11	Samuel Hunt.	J. Edgar Martin.
Joliet	55,000	4	2	180	55	G	D	5	38	C. W. Royce.	Thos. Gorey.
Kewanee	15,000	3	½	....	7	F	R	1	6	D. W. Hawthorne.	W. S. Buckingham.
Mattoon	15,000	3	0.3	60	24	F	S	2	8	J. C. Weaver.	Wm. Byers, Wm. Haskell, Osborne.
Monmouth	10,000	4	0.2	....	28	G	D	2	5	T. A. Wilson.	W. E. Loftus, John Strand, Jas. Costello.
Murphysboro	12,000	3.5	3.5	64	14	F	...	1	4	Alb. Herring.	D. M. Anderson.
Oak Park	35,000	4½	1	94	85	G	D	3	21	H. J. Schoff.	G. W. Hales, B. B. Dutton, D. Nelson.
Paris	9,500	4.5	1	45	14	G	S	1	5	C. H. Ulrich.	Frank Clinton.
Pana	8,000	4	0.1	35	6	F	SD	1	....	G. W. Searles.	Grover Clements, Chas. Hill, J. L. Haynes.
Pekin	12,500	6½	0.1	80	19½	G	SD	1	5	J. F. Jaeckel.	J. W. Zuckwiler.
Springfield	63,000	8.6	1	167	73	F	R	8	77	Peter Jacobs.	R. R. Reece, Comr.
Urbana	11,000	....	....	....	....	G	D	1	....	W. H. Roughton.	J. B. Bennett, Roger Tyrell, Elmer Johnson.
Indiana—											
Anderson	32,000	7	¾	50	25	G	D	4	25	C. G. Alford.	H. Urban, E. Station, S. Heavlin.
Brazil	12,000	4	1	50	15	G	R	1	6	Oscar Todd.	Frank Crawford, John Row, Will Treagor.
Crawfordsville	12,000	16	2½	25	14	G	D	2	10	J. W. Hurley.	H. T. Schenck, Carlton Snyder, M. U. Borroughs.
Elkhart	23,000	6	0.1	100	21	F	D	4	25	Alex Dotson.	J. B. Davidson, F. E. Hughes, Eli Coleman.
Elwood	13,000	....	....	....	....	G	D	1	....	Herman Barber.	Charles Meisley, James Bradley, W. E. Hare.
Frankfort	10,000	3	0.1	46	14	G	D	1	6	Roy Henderson.	I. E. Scripture, Q. A. Kennedy, H. F. White.
Gary	45,000	3	....	....	120	G	S	4	49	Wilfred Grant.	K. M. Burr, Albert Carlson.
Goshen	10,000	4	4	40	10	G	SD	2	6	John Snobarger.	Wm. Collins, N. W. Monroe, Edw. Nymeyer.
Huntington	15,000	2.7	....	51	17	G	S	2	12	Edwin Beard.	Fred Bowers, Jacob La Monte, John Kenower.
Indianapolis	300,000	46	....	....	....	G	D	31	335	J. H. Johnson.	Albert Gall, A. H. Wahl, Robt. Metzger.
Kokomo	20,000	3½	0.4	80	52	F	D	3	17	Ed. Shauman.	Wm. Helmich, Wm. Webb, T. F. Lynn, B. P. W.
Logansport	21,000	11	9	58	5	F	...	5	24	John Griffin.	Adrian Beale, Mayor; F. V. Guthrie, St. Comr.; Thos. Flinn, Cy. Engr.; Harry Thompson.
Michigan City	23,000	25	3	....	35	G	D	3	16	I. C. Bauman.	A. W. Voss, Ohms, Bennett, Bates.
Muncie	29,000	4	0.2	75	14	G	D	3	24	J. E. Casey.	P. W. Goebel.
Portland	6,000	6	1	40	6	F	D	1	3	A. O. Ball.	Frank Wilt, Harvey Humphries, W. H. Hutchins.
Richmond	30,000	4½	2	69	13	G	D	5	26	E. E. Miller.	Chas. Marlatt, Alfred Bavis, John McMinn.
Shelbyville	10,000	2	1	28	2	G	D	1	16	J. H. Briggs.	Chas. Jackson, Joseph Pearson, Edward Burkher.
South Bend	70,000	15	....	198	71	G	SD	9	66	I. W. Sibrel.	B. F. Augustine, A. Hibbard, Clement Smogor.
Terre Haute	75,000	10	1	220	53	F	D	10	81	Harry Bledsoe.	Jacob Frisz, I. F. Mehegan, Oscar Kantmann.
Vincennes	20,000	....	....	....	26	G	S	3	14	G. L. Snyder.	
Whiting	7,500	1½	½	13	12½	G	D	1	8	C. C. Lampman.	J. W. Burton, R. Spurrier, A. Hulaska.
Iowa—											
Burlington	25,000	10	4	....	50	G	D	6	17	L. F. Blank.	Ed. Matsch.
Cedar Rapids	45,000	13	2	....	52	G	D	6	38	W. A. Mohrbacher.	Martin Evans, Comr. P. S.
Council Bluffs	32,000	16	0.2	....	....	G	RD	5	27	W. A. Williamson.	F. M. Williams, Gus Clausen, W. A. Williamson.
Davenport	50,000	10½	2	....	90	G	RD	8	55	Peter Denger.	Wm. H. Gosch, B. Raben, W. Moeller.
Des Moines	105,568	54	1	185	135	G	D	15	127	Will Burnett.	Ben Woolgar, Comr. P. S.
Dubuque	45,000	12½	....	....	....	G	R	6	52	J. R. Reinfried.	G. Ragatz, J. Drexler, J. McEvoy.
Ft. Dodge	20,000	5¾	0.4	90	36	G	SD	1	9	F. B. Trusty.	C. H. Smith, J. F. Ford, F. W. Collins.

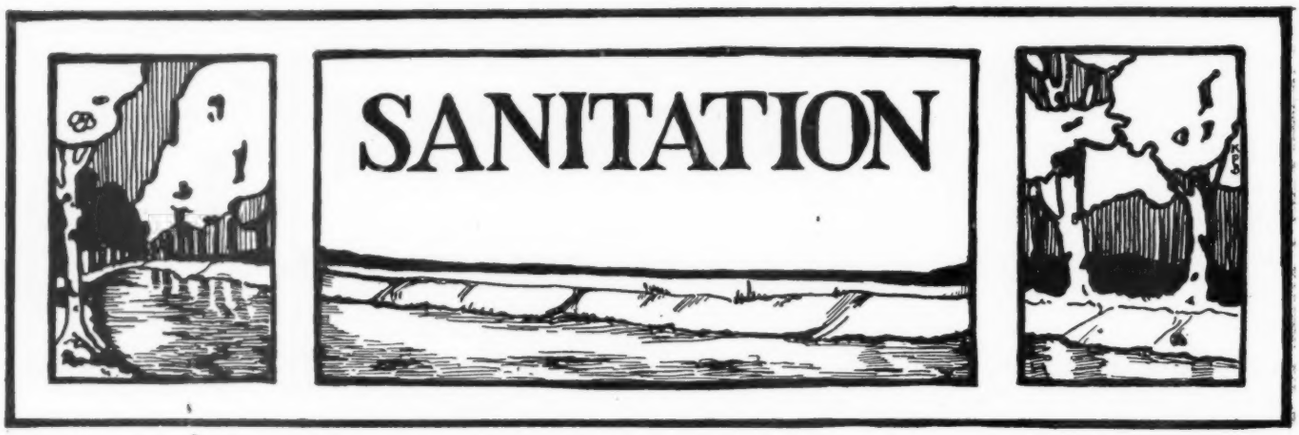
City	Pop.	Area Sq. Mi.	Area Fire Limits Sq.m	Mi. Streets	Mi. Paved Streets	Condition of Streets	Water Service	No. Fire Houses	No. Full-time Men	Name of Chief	Members of Fire Committee, Chairman Named First
Iowa City	12,000	....	....	....	....	F	...	2	....	J. J. Clark.	John Breese.
Keokuk	15,175	20	20	300	100	F	D	3	12	John Anderson.	Fred Hilpert, Jr., Comr. P. S.
Marshalltown	16.065	8.6	2	89	22	G	D	2	10	A. T. Anderson.	Ed. T. Austin, Dir. P. S.
Mason City	31,000	12	0.8	130	40	F	D	1	15	Thos. Conner.	C. A. Codwise.
Muscatine	16,178	....	....	....	....	..	SRD	3	13	J. J. Brown.	John Deircks.
Oskaloosa	11,000	4	4	....	15	G	D	1	5	I. H. McCracken.	Al. Mendenhall, Lee Fansher, J. H. Pickett.
Ottumwa	25,000	12	6	....	35	F	R	2	....	C. W. Slvan.	Fritz Ehrman, Comr. P. S.
Sioux City	62,000	44	....	....	....	F	...	8	51	G. M. Kellogg.	Geo. E. Ward.
Waterloo	33,000	13	0.4	192	52	G	D	2	24	A. A. Dunham.	M. J. Morgan, J. W. Reckert, E. G. Rath.
Kansas—											
Atchison	18,000	6	1	90	29	G	SRD	2	15	John Compton.	C. A. Brown, Frank Bracke, L. J. Ham, Fayet Kested, H. M. Ernst.
Chanute	10,000	2¼	0.1	235	21	G	D	1	4	N. E. Barker.	Mayor, J. L. Marrison; W. M. Barber, W. T. Sams, N. E. Barker.
Ft. Scott	13,000	2	½	106	50	G	SD	1	8	M. W. Smith.	P. C. Hesser.
Independence	13,500	6	0.4	....	42	...	D	1	6	Roy Pitts.	Mayor, R. R. Bettman.
Kansas City	100,000	18	...	297	140	G	D	9	112	John McNarrey.	Commisioners.
Leavenworth	22,000	7.4	7.4	....	....	G	RD	0	17	M. Bahler.	Mayor, Ed. Crancer.
Manhattan	7,000	4	....	35	28	G	R	1	2	W. P. Coudray.	S. F. Goheen.
Newton	9,000	4	0.2	35	20	F	SD	1	4	Guy Kemper.	Mayor, A. J. Duff; G. C. Cook, A. B. Gilbert.
Parsons	20,730	2.5	0.1	50	34	F	SD	2	10	W. A. Buel.	
Pittsburg	22,000	4¾	¼	90	25	G	D	2	14	T. W. Howe.	Mayor.
Salina	12,000	7	1	40	19	G	...	1	6	B. N. Camp.	A. L. Wolff, J. V. Osberg, John Mishler.
Topeka	53,000	8½	1	175	90	F	D	6	77	Joseph Hanlon.	Mayor.
Wichita	65,000	28	1	450	82	G	D	5	50	A. G. Walden.	Mayor, O. H. Bently.
Kentucky—											
Ashland	12,000	2.5	1	35	35	G	R	1	8	H. H. Davenport.	J. H. McCleary, Howard Collins, R. O. Poague.
Hopkinsville	12,000	4	4	80	56	GF	S	1	4	E. P. Fears.	Frank Bassett.
Lexington	41,500	8	3	40	30	G	D	5	43	W. A. Jesse.	Geo. Laud, H. M. Schoonmaker.
Newport	32,500	1¼	....	25	19	F	R	3	16	Sam'l Rardin.	C. Ebert, Comr. P. S.
Louisiana—											
Morgan City	6,000	1	1	15	6	F	SD	1	3	T. G. Thorgesen.	Dancy Winchester, Thos. Shannon.
Shreveport	42,000	10	5½	....	49	G	S	6	44	Chris O'Brien.	Geo. Thurber.
Maine—											
Bath	9,000	15	15	50	....	F	D	5	3	C. E. Parks.	Ralph Conel, Henry Leeman, Chas. Hooper, Harry Bonire, Geo. Barker, Alex Mason.
Lewiston	30,000	35	6	140	12	F	R	4	10	M. J. Moriarty.	G. S. Libby, Mayor; L. J. Braun, S. F. Brogan, J. E. Scott, F. M. Langley.
Portland	62,000	22	¾	153	44	G	D	13	97	A. D. Butler.	Mayor, W. G. Chapman; C. B. Clarke, J. P. McCarthy, S. O. Symonds, C. E. Files, M. J. Bowen.
Skowhegan	5,500	4	4	....	0	F	S	1	1	Mark Sarage.	E. C. Butler, R. T. Patten, M. C. Viles.
Maryland—											
Baltimore	.....	....	...	....	....	...	R	48	797	August Emrich.	Richard H. Johns, Albert Diggs, S. T. Manning.
Cumberland	28,000	....	3	25	17	G	R	3	17	R. C. Hoenicka.	Oscar A. Eyerman, Comr.
Massachusetts—											
Adams	14,000	25	8	40	20	G	...	3	....	H. A. Jones.	G. B. Adams, F. M. Waters, P. P. Smith.
Attleboro	18,000	....	....	90	0	G	S	5	19	H. R. Packard.	H. R. Packard.
Beverly	23,000	15	....	76	16	G	R	6	20	R. H. Grant.	T. D. Connolly, Paul Eaton, Edward Thompson.
Boston	.....	....	....	....	....	...	...	..	....		
Brockton	65,000	22	22	152	44	F	S	6	74	W. F. Daley.	W. E. Johnson, W. L. Gleason, O. E. Peterson, H. D. Bent, F. D. Rowe.
Brookline	.....	....	....	....	....	...	...	..	....		
Chelsea	43,426	2½	1¼	....	....	...	R	5	45	D. M. Hudson.	R. A. Voke, W. A. Morse, J. E. Wholley.
Chicopee	30,138	....	....	....	....	...	...	6	32	J. E. Pomphret.	
Dedham	10,000	20	....	40	....	G	S	3	6	H. J. Harrigan.	
Easthampton	11,000	14½	14½	58	8	F	D	2	4	A. J. Krenle.	
Fitchburg	41,000	28	1	141	8	G	RD	6	45	T. F. Murnane.	J. H. Delaney, J. B. Fellows, G. H. Gibson, W. G. Hayes, T. H. Powers.
Franklin	7,000	9	9	84	0	F	S	4	0	E. L. Metcalf.	H. E. Ruggles, A. J. Gallison, G. E. Emerson, F. P. Chapman.
Gardner	17,000	23	1	....	....	G	R	3	6	G. S. Hodgman.	J. W. Davis, W. J. Littaker, Ellsworth Brown.
Lawrence	90,000	6	....	114	19	G	RS	9	71	D. E. Carey.	J. W. Cadogan, Dir. P. S.
Lowell	116,000	14	....	215	69	F	R	14	134	E. F. Saunders.	N. F. Putnam, Comr.
Lynn	100,000	11	3	....	....	G	R	10	97	E. E. Chase.	Mayor, G. H. Newhall.
Malden	50,000	4¾	½	65	5	F	RD	6	51	J. T. Nichols, Actg.	J. H. Hannan.
Marblehead	7,500	5	...	50	1	G	SR	2	5	J. T. Adams.	J. T. Adams, W. H. H. Atkins, J. T. High, T. H. Rhoades, C. A. Goodwin.
Maynard	6,500	1½	1	12	0	G	R	1	2	G. H. Gutteridge.	
Melrose	17,314	....	0.1	62	1	G	R	3	11	Joseph Edwards.	T. H. Gilman.
Milford	14,000	14	....	85	0	F	SD	5	1	E. J. Burke.	E. J. Burke, Norman Adams, J. E. Higgeston.
Milton	8,800	....	....	55	....	G	D	3	13	J. Harry Holmes.	
New Bedford	112,000	19	....	....	....	G	RD	11	108	E. F. Dahill.	S. A. Goodfellow, S. E. Bentley, G. D. LaCroix, P. Andette.
Newburyport	15,000	....	1	38	5	F	S	5	2	J. L. Lewis.	W. S. McKay, Edw. Perkins, Bamford, Jos. Blood, Philip Weare, Herbert Patten.
Norwood	12,500	11	3	55	12	G	SD	2	3	J. F. Boyden.	C. A. Bingham, Cy. Mgr.
Peabody	18,000	6	1	75	0	G	RD	5	11	J. F. Barrett.	
Quincy	40,600	17	....	91	10	F	D	6	34	Faxon Billings.	B. P. Gallagher, Palmer Boleteo, Griffin, Geary.
Revere	30,000	6	....	....	....	F	...	5	25	A. L. Kimball.	Mayor, A. B. Curtis, H. J. Harding.

City	Pop.	Area Sq. Mi.	Area Fire Limits Sq. m	Mi. Streets	Mi. Paved Streets	Condition of Streets	Water Service	No. Fire Houses	No. Full-time Men	Name of Chief	Members of Fire Committee, Chairman Named First
Salem	4,300	8	....	....	....	F	D	6	43	H. C. Kimball.	F. W. Broadhead, J. L. Sheehan, J. H. Gruley.
Spencer	6,000	....	....	8	¼	G	SR	2	..	J. W. Rogan.	
Taunton	36,161	50	50	150	....	F	SD	5	36	F. A. Leonard.	J. P. Carr.
Wakefield	13,000	8	0	48	12	G	...	4	6	W. E. Cade.	John Meloney.
Waltham	31,000	14	0.1	95	0	G	S	5	23	G. L. Johnson.	
Watertown	19,000	4	4	66	66	F	R	2	12	J. W. O'Hearn.	A. W. Bixby.
Wellesley	7,500	14	14	200	200	G	R	4	7	J. P. Doyle.	Board of Selectmen.
Winthrop	12,288	2	....	33	....	G	RS	3	8	F. W. Woollcott.	H. N. Bangs, F. G. Smith.
Woburn	16,410	10	....	55	....	F	...	3	12	F. E. Tracy.	W. R. Merchant, E. H. Marshall, J. F. McGovern, Lewis Menchin, J. P. Lynch.
Worcester	170,000	35	....	....	....	F	GD	18	212	W. N. Avery.	H. A. Cooke, E. W. Jenkins, C. W. Corbett, F. S. Clark, W. W. Lassey, H. A. Nash, J. V. Rafferty.
Michigan—											
Adrian	11,000	4	¼	42	8½	G	D	2	4	L. L. Knowles.	Mayor, A. D. Billings; F. T. Older, L. L. Knowles.
Albion	8,000	4	0.1	50	5	F	S	1	4	F. W. Griswold.	Cy. Mgr., Slocum.
Alpena	14,000	7½	.	47	15	G	D	3	12	R. E. Wilson.	H. G. Robey, Cy. Mgr.
Battle Creek	35,000	6	.2	....	....	G	SD	4	35	W. P. Weeks.	J. B. MacGregor.
Benton Harbor	11,000	2½	¾	45	12	G	D	1	6	Irving Clauser.	Wm. Jewell, Ed. Warner, Morse Hall.
Cadillac	10,000	7	1	50	18	F	D	1	4	J. T. Maxwell.	T. V. Stephens, Cy. Mgr.
Flint	75,000	6	....	325	32	F	D	3	42	E. H. Price.	F. R. Armstrong, Geo. Streat, John Collins, Frank Torrey, Homer Vetts, E. G. Frazer.
Grand Rapids	125,000	19	1	305	54	G	SRD	12	187	Geo. Boughner.	Wm. E. Elliott.
Hillsdale	5,001	5½	1½	38	5	G	D	1	2	R. H. Morlock.	David Gould, C. H. Tiller, Frank Johnson.
Holland	12,000	4	....	40	4	G	RD	2	2	C. Blom, Jr.	B. Mulder, Fred Jackson, John Schouten, H. Brusee, D. M. Coak.
Iron Mountain	9,500	6	0.1	40	10	...	R	2	8	Lee Lalonde.	Petter Rule, J. Landercock, A. Bant.
Ironwood	19,000	....	....	....	....	F	SD	1	8	Will Boyer.	Adolph Mueller, Patrick Mullen, Gust Swanson.
Jackson	45,000	9	....	....	....	GF	D	5	41	B. F. King.	City Manager.
Lansing	55,000	8	½	150	19	GFB	S	5	45	H. R. Delfs.	C. M. Watson, H. T. Thomas, Homer Luse, C. Bennett, Lewis Imes, Geo. Walt.
Marquette	12,000	....	....	33	....	G	D	2	5	W. J. Johnston.	J. P. Werner.
Menominee	14,000	....	....	....	....	F	D	3	14	L. C. Collins.	Simon Bolin, Bruno Schultz.
Muskegon	35,000	6	1	115	43	G	D	6	27	Napoleon Belfy.	Mitchell Brown, Wm. Cayo, Peter Kemp.
Pontiac	25,000	8¾	....	....	15	F	D	1	15	J. B. Austin.	R. J. Lounsbury.
Saginaw	70,000	12	....	220	74	...	D	10	58	R. B. Hudson.	Mayor H. F. Paddock, Comr.
St. Joseph	6,000	....	....	....	....	G	D	1	....	H. G. Hughson.	J. J. Miller.
Traverse City	12,000	7	2	....	6	G	D	4	8	T. C. Murray.	G. W. Lardie, Comr.
Minnesota—											
Cloquet	7,031	3	0.8	19	1	G	S	1	8	Geo. Mayhan.	Frank Yetka, Andrew Norman.
Duluth	90,000	60	....	....	....	F	...	9	111	Joseph Randall.	B. Silberstein, Com. P. S.
Hibbing	15,000	1¾	½	22	5½	G	DS	3	28	C. McIlhargey.	John Curren, D. D. Haley & Chief.
Minneapolis	354,000	53½	9	882	250	G	R	30	425	C. W. Ringer.	L. N. Ritten, E. W. Hawley, E. J. Swerney, John Peterson, T. O. Dahl.
St. Paul	285,000	54	4½	821	70	21	RD	23	312	Henry Devlin.	Henry McColl, Comr. P. S.
Stillwater	10,180	3	0.2	....	2	F	SD	1	8	Jas. McGann.	Mayor, J. R. Kollmer; M. L. Murphy, Ernest Torinna, Hugh Campbell, Roble Woerz.
Winona	25,000	9	0.4	....	....	G	S	4	31	W. C. Norton.	H. J. McConnon, J. R. Schooth H. J. Willis, F. J. Buchholz, J. W. Jeneczek.
Mississippi—											
Greenville	12,500	4	1	....	1½	F	...	4	18	E. V. Donovan.	J. E. Leppert, J. N. Croch, Joe Milzinski.
Vicksburg	22,000	10	0.2	45	12	G	S	6	25	J. W. Wilks.	W. H. Miller, W. J. Hossley, Mayor, J. J. Hayes.
Missouri—											
Carthage	12,000	4	¼	....	2	F	D	1	7	S. S. Mathews.	L. S. Dunham, J. W. Rodd.
Columbia	15,000	6	½	96	25	G	D	1	4	E. N. Kurtz.	Percy Klass, E. B. McDonald, W. D. Shaw.
Hannibal	22,000	3½	1	20	10	...	R	3	11	T. B. Parks.	John Snitzer, Comr.
Kansas City	350,000	60	10	1,100	450	G	D	26	396	J. C. Egner.	W. W. Harnden.
Moberly	15,000	3¾	¼	100	28	G	R	1	4	J. D. Crews.	W. R. Butler, E. P. Hutchinson, O. R. Nise.
Poplar Bluff	11,000	8	0.1	20	7	F	SD	1	2	C. E. Langley.	I. D. DeLapp, C. E. Langley, Ed Patton, W. T. Morris.
St. Charles	10,000	2½	¾	30	2	F	D	2	4	Henry Hatchmeyer, Jr.	Henry Brocker, Herman Feldman, Ford Hallbruegge.
St. Joseph	80,000	13	7	200	110	G	R	16	100	P. P. Kane.	
St. Louis	.....	....	....	....	....	...	...	49	819	F. E. Henderson.	
Springfield	50,000	7½	3	300	150	G	SD	4	43	W. R. Price.	Mayor Gideon.
Trenton	7,500	6	2	80	7	F	SD	1	1	G. Himen.	M. A. Christopher, Ben Hall, G. H. Titcomb.
Webb City	15,000	6	1	12	1½	F	D	2	7	G. C. Wilson.	Ben Reynolds, Ed. James, M. Westerman, E. Culver, J. Schwartz, G. W. Crocker.
Webster Groves	10,000	4	0.1	70	50	G	D	2	7	R. M. Odien.	John Nolan, H. C. Ryan, E. Booth.
Montana—											
Anaconda	18,000	4	1	18	3	F	R	1	7	Chas. Collins.	Emery Kell, Jas. McCavitt, John Tierney.
Bozeman	7,500	4	¼	43	8	F	R	1	3	W. G. Alexander.	E. J. Hines, M. J. O'Connell, J. N. Pratt.
Kalispell	5,000	2	0.2	17	2	F	R	1	3	C. D. O'Neil.	W. P. Twining, G. A. Brinkman, Jno. Fishel.
Missoula	20,000	6	6	....	4	F	R	1	9	P. F. Loffner.	T. E. Kemp.

City	Pop.	Area Sq. Mi.	Area Fire Limits Sq.m	Mi. Streets	Mi. Paved Streets	Condition of Streets	Water Service	No. Fire Houses	No. Full-time Men	Name of Chief	Members of Fire Committee, Chairman Named First
Nebraska—											
Columbus	6,000	1½	....	50	½	F	SD	3	0	A. J. Galley.	Frank Rudat, L. F. Rector.
Grand Island	15,000	4	4	200	8	F	D	4	5	T. M. Dillon.	J. E. Hanna.
Nebraska City	6,200	8	0.1	25	5	G	D	1	2	H. H. Bartling.	Bert Ryder, O. A. Roos, Herman Schomerus.
Norfolk	9,500	5	4½	45	10	F	S	3	2	V. A. Nenow.	E. Bruggeman, M. C. Fraser, Matt Shaffer, Jr.
Nevada—											
Reno	13,500	....	½	....	....	G	R	2	20	R. B. Howcroft.	Robt. Nelson, P. Steffas, E. Twaddle.
New Hampshire—											
Concord	21,497	63	4	....	....	G	R	6	13	W. C. Green.	F. M. Dodge, G. O. Robinson, Roy Fraser.
Laconia	14,000	10	3	36	0	G	R	3	5	A. W. Spring.	C. E. Rowe, C. J. Avery, C. R. Davis.
Manchester	80,000	33	33	....	....	F	...	10	....	T. W. Lane.	H. R. Bennett, A. L. Garmon, H. L. Clough.
Nashua	30,000	27	7	....	....	G	D	4	28	C. H. Whitney.	H. C. Lintott, C. H. Austin, E. W. Duncklee.
Portsmouth	13,000	....	...	....	....	G	S	4	7	W. F. Woods.	Valentine Hitt, Clarence Smart, John Sullivan.
New Jersey—											
Elizabeth	85,000	10	4	128	64	G	D	10	75	Aug. Gerstung.	R. L. Patterson, Frederick Kurtz, Frederick Bender, C. Schandler, Otto Wagner.
Irvington	21,000	3	0	50	15	F	...	3	13	H. J. Groom.	Leonard Setaro.
Jersey City	271,000	19	19	203	142	G	D	27	350	Roger Boyle.	Frank Hoyne, Dir. P. S.
Passaic	65,000	3½	....	....	....	...	...	6	54	R. H. Bowker.	Jno. H. Kehoe, Comr. P. S.
Plainfield	30,000	5	1	30	30	F	...	4	5	T. O. Doane.	John Core.
Rutherford	8,500	....	....	....	2	G	SD	4	2	E. O. Farnum.	E. J. Kennedy, F. W. Sheaf, T. J. Johnson.
Trenton	106,000	....	....	....	....	G	RS	12	....	J. W. Bennett.	G. B. LaBarre, Dir. P. S.
New Mexico—											
Albuquerque	15,000	2	0.4	53	2	F	R	2	11	J. W. Burnett.	W. F. Switzer, S. S. Gilbert, C. G. Gibson.
Roswell	8,500	8	...	....	3½	F	D	1	6	Chas. Whiteman.	A. L. Whiteman.
New York—											
Albany	110,000	19	....	150	110	G	D	14	188	W. W. Bridgeford.	W. G. Knapp, Jno. Hawkins, M. Fisher.
Amsterdam	35,000	4½	2½	78	7	G	R	6	33	Wm. Stichel.	F. J. Blood, Jos. Nadler, John Hungerschafer.
Auburn	36,000	9	1	70	13	G	D	7	47	E. J. Jewhurst.	D. P. Swerney, Comr.
Batavia	14,000	....	....	....	7	G	D	2	7	W. H. McBride.	Geo. Winters, Hartley, Ware.
Binghamton	53,688	10	½	120	27	F	D	8	81	A. H. Lyon.	F. W. Spaulding, Comr. P. S.
Cohoes	24,000	5	1¾	31	13	G	...	5	22	T. C. Collin.	J. H. Mitchell, Comr. P. S.
Corning	15,000	....	....	....	....	G	R	2	10	J. W. McCarthy.	Mayor, G. W. Lane; V. L. Cole, H. J. Millspaugh.
Cortland	13,500	4½	1	57	25	G	SD	1	5	E. M. Eastman.	Edward Alley, C. E. Thompson, W. H. Gilbert.
Elmira	.....	7½	....	....	....	G	...	..	47	J. H. Espey.	H. N. Hoffman, Wm. Ufford, W. E. Sheive.
Fulton	12,400	....	3	40	10	F	SD	1	8	H. L. Waugh.	L. A. Richardson, John Cavanaugh, M. E. Mead.
Jamestown	38,000	10	BD	106	32½	G	R	6	40	H. S. Rodgers.	R. Y. Eden, Gust. Hultquist, Gust. Anderson.
Little Falls	15,000	26	....	25	15	...	...	2	5	E. J. Cooney.	Robert Nolan, T. L. Rogers, W. B. Shepardson, D. F. Cunningham.
Newburg	30,000	4	....	....	....	G	RD	9	....	Michael O'Brien.	John Sloan.
New Rochelle	31,758	12	12	....	....	G	...	6	28	James Ross.	J. P. Nestler, J. S. Adams, T. E. Winter.
Oswego	26,000	8	2	85	16	F	DR	4	18	R. G. Blackburn.	F. A. Schentgow, E. J. Andefinger, F. Gallagher, T. J. Kehoe.
Plattsburg	12,000	5	0.4	22	2	G	D	1	6	E. Seymour.	P. K. Knowles, R. H. Nash.
Rochester	250,000	....	...	....	....	G	GD	26	....	Charles Little.	R. A. Hamilton, Comr. P. S.
Rome	24,000	72	4	....	....	G	R	3	21	G. M. Bower.	H. C. Wiggins, E. S. Williams, E. D. Besley, N. H. Jones.
Schenectady	90,000	9½	9½	175	165	G	D	11	100	H. R. Yates.	J. E. Cole, Comr. P. S.
Solvay	5,500	....	....	....	....	G	R	3	0	R. R. Blair.	W. P. Kanar, Vil. Pres.
Syracuse	150,000	18	18	300	98	F	SR	17	215	T. F. Ryan.	W. W. Nicholson, Comr. P. S.
Tonawanda	10,000	....	....	....	....	F	D	4	6	C. R. Rech.	Alb. Lozo, Christ. Ackerman, Herman Licht.
Troy	80,000	10	....	100	75	G	R	17	85	Patrick Byron.	J. F. Cahill, Comr. P. S.
White Plains	20,000	10	10	74	5.6	F	SD	6	0	F. J. Keefe.	J. H. Calhoun, Comr. P. S.
Yonkers	95,000	21	....	145	114	G	R	10	126	J. J. Mulcahey.	Chas. Miller, J. S. Davis, F. H. Stillwell.
North Carolina—											
Asheville	26,000	6.7	0.5	105	37	G	R	1	7	J. H. Wood.	D. H. Ramsey, Comr. P. S.
Durham	23,000	4	½	....	....	F	D	4	26	D. C. Christian.	L. S. Christian, C. P. Norris, A. W. Sorrell.
Elizabeth City	12,000	4	0.3	25	12	G	D	..	2	J. B. Floro, Jr.	J. C. Commander, Cy. Mgr.
Greensboro	23,000	4	1	50	20	GF	R	4	14	F. N. Taylor.	R. M. Reese.
High Point	13,000	4	¼	20	¼	B	S	3	6	E. K. Ingram.	A. Lyon.
New Bern	16,000	4	2	25	5	G	SD	2	6	S. H. Coward.	S. H. Scott, A. T. Dill, J. Crabtree.
Raleigh	30,000	4	½	60	20	G	SD	..	28	C. D. Farmer.	O. G. King, Comr.
North Dakota—											
Jamestown	.....	2	0.1	12	0	F	SD	..	1	J. G. Bensch.	Wm. Hall, W. R. Hilton, Wm. Noel.
Ohio—											
Alliance	20,000	4	0.1	58	35	F	D	3	15	J. E. Held.	J. H. Patton.
Ashland	10,000	5	4	75	14	G	S	1	2	Nathan Strauss.	Lloyd Mathews, Chas. Clark.
Bellaire	15,000	3	....	35	25	F	R	3	4	Jas. R. Fitton.	T. B. Phillips, Dir. P. S.
Bellefontaine	9,000	4	0.03	50	4½	F	R	2	7	H. S. Blair.	J. C. Brooks, J. C. Reinhart, Fred Spittle.
Canton	65,200	9	4	275	65	G	D	8	58	R. O. Mesnar.	R. J. Kunkel.
Conneaut	12,000	4	1	24	12	G	RD	3	11	T. J. Gough.	Martin, Risley, Fredericks.
Delaware	10,000	4	...	20	8	F	D	2	5	C. W. Keiser.	Chas. Owens, John White, Patrick Foley.
E. Cleveland	12,200	3	0	....	....	G	D	2	22	E. T. Woolway.	Jas. Sanborn, W. Merrick, Wm. Cowen.
Elyria	22,000	7	¼	60	44	G	D	3	24	W. N. Bates.	R. F. Vandemark, Dir. P. S.; Asaph Jones, John Carson, F. R. Cantle.
Gallipolis	7,000	1½	....	....	5	G	DR	1	2	W. R. White.	J. W. Miller, Dir. P. S.
Hamilton	40,000	5½	5½	60	30	G	RD	7	41	W. C. Dowty.	A. E. Egry, Dir. P. S.

City	Pop.	Area Sq. Mi.	Area Fire Limits Sq.m	Mi. Streets	Mi. Paved Streets	Condition of Streets	Water Service	No. Fire Houses	No. Full-time Men	Name of Chief	Members of Fire Committee, Chairman Named First
Lancaster	16,000	5	0.4	50	15	G	R	1	7	C. A. Landerfelt.	Joshua Clark.
Lima	43,523	7	1	125	45	G	D	4	35	J. C. Mack.	E. C. Rohm, Dir. P. S.
Lorain	35,000	10	2	84	35	F	D	8	31	D. E. Hatt.	M. J. Lesher, M. N. Walker, David Kelly.
Marietta	16,000	5	5	35	24	G	R	2	12	G. B. Holst.	T. E. Sayler, Dir. P. S.; J. Schultheis, L. A. Dickinson, Geo. Bonnell.
Marion	25,000	6	1.5	50	35	F	SD	3	21	T. J. McFarland.	
Newark	30,000	5	0.1	52	25	F	RD	4	22	Louis Bausch.	C. A. Bigbee, Dir. P. S.
Norwood	23,000	3	....	44	....	F	S	3	21	J. A. Geller.	L. O. Saur, Dir. P. S.
Painesville	8,000	3	0.4	25	16	G	...	1	3	T. W. Morgan.	D. J. Connell, Dir. P. S.
Portsmouth	32,000	2	....	40	39	G	R	3	26	G. L. Koerner.	W. S. Crummer, C. W. Wilson, Harold Rise.
Salem	10,000	2½	....	30	15	15	...	3	2	Wm. Bolen.	D. E. Sheehan, Dir. P. S.
Tiffin	15,000	5	0.1	50	25	...	D	2	13	A. D. Harris.	A. Litzenberger, Welter Fox.
Toledo	240,000	32	3.3	442	241	G	D	17	234	L. H. Elling.	J. C. Newton, Dir. P. S.
Wooster	8,500	3	0.1	33	15	F	RD	2	4	Ed. Snavely.	Wm. Long, Geo. Fisher, H. Rhodes, F. L. Steinmetz.
Youngstown	110,000	25	½	....	....	G	DS	10	92	J. Wallace.	Wm. Harrison, Wm. Reese, A. Shale.
Oklahoma—											
Guthrie	1,400	....	0.3	150	25	G	SD	..	12	Theo. Barnthouse.	R. N. Dunham.
McAlester	15,000	5.7	0.16	125	12	F	S	2	13	I. L. Holbrook.	J. I. Woods.
Oklahoma City	85,000	17	5	425	130	G	D	10	76	R. M. Brooks.	Ed. Overholser, Mayor; J. T. Highby, Comr. P. S.
Sapulpa	14,500	3½	3½	41	7	F	D	1	8	A. W. Smalley.	Don McMasters.
Shawnee	18,000	2	....	35	23	G	SD	3	10	L. A. Brown.	A. J. Cammack, Tom Adams, Dick Richards.
Oregon—											
Medford	10,000	4	1	40	20	G	D	1	6	J. W. Lawton.	John Mann, J. M. Keene, Frank Amy.
Pennsylvania—											
Altoona	52,127	....	....	63	41	F	R	9	58	T. W. Allemann.	W. C. Myton, Dir. P. S.
Berwick	5,000	1	1	25	1.5	B	RD	3	....	G. W. Brownson.	Herman Legevira, James Lee, E. A. Glenn.
Butler	25,000	3	3	40	30	F	R	2	12	J. W. Lefevre.	Jas. Orr, Jas. Green, Donald McDonald, Geo. Varnum, Henry Miller.
Carnegie	11,430	2	2	13	11	G	R	1	6	Robt. Edwards.	I. N. Dushane, J. L. Wright, D. B. Johns.
Coaldale	5,154	....	....	....	0	F	D	1	....	James Bynon.	John Willing, Sr., John Maguire, Fred Fudge.
Coatesville	15,000	5	....	30	½	F	RD	3	4	F. E. Soule.	H. M. Zook, Comr.
Connellsville	16,000	2	1½	29	12	F	RD	1	8	W. E. DeBolt.	M. B. Pryce, Comr.
Easton	32,000	3½	¾	60	8	F	RD	5	25	T. P. Ricker.	W. P. Strickland, Comr. P. S.
Erie	92,000	7	1½	130	67	G	S	9	106	J. M. Duerner.	Henry Kissler, Dir. P. S.
Franklin	10,000	7½	½	14	9½	F	...	1	2	F. D. Grimm.	Theodore Clulow, Dir. P. S.
Greensburg	20,000	3	3	27½	19½	G	...	6	0	O. F. Myers.	H. J. Hensell, Geo. Weightman, Robert Feightner, Harry Orr, Saml. McCrady, W. T. Dun, John Temble, W. G. Conners.
Hazleton	32,000	6	....	....	7½	F	R	3	7	L. J. Kepping.	W. J. Cullen, Jacob Martin, Chas. Bittenbender, Wm. Gerlach.
Homestead	25,000	1	¾	....	A	F	R	3	9	C. R. Bryce.	John Eicholtz, Frank Fulton, Wm. Hawley, George Milton, Thos. McGeven.
Jeannette	10,000	0.9	0.1	162	7	GF	R	3	4	P. C. Schlingmann.	E. M. Gaughan, J. Hart, G. W. Whiteman, Ed. Egan, Dr. Ringer.
Latrobe	10,000	1	1	....	....	G	...	5	0	J. L. Ackeman.	James Weimer, Geo. Creteau, S. J. Cennow.
Lewistown	10,000	....	....	....	....	G	...	4	0	Tim S. Johnson.	F. W. Sills.
Meadville	15,000	....	1½	33	26	G	R	4	5	Howard Dowdell.	Geo. Maxwell, Dir.
Munhall	6,000	....	....	20	15	G	D	3	2	E. M. Cox.	Chas. Menk, A. J. Tiley, Jas. Gifford.
New Castle	50,000	10½	0.05	112	45	G	S	7	27	F. J. Connery.	J. M. Hamilton.
Philadelphia	1,700,000	129½	129½	1,655	1,467	G	R	75	1,047	W. H. Murphy.	
Pittsburg	575,000	41	....	983	550	G	R	63	905	J. F. Richards.	J. P. Kerr, Pres. Council.
Pottsville	28,000	3½	3½	47	0.5	G	R	7	1	W. L. Stevenson.	J .O. Bearstler.
Rankin	9,000	¾	0	13	5	F	D	1	1	H. N. Fritzius.	Harry Johns, Wm. Watkins, J. K. Milligan.
Uniontown	19,990	21	½	30	16	F	R	2	6	G. H. Litman.	Robert Hogsett, Dir. P. S.
West Chester	13,250	....	1½	....	....	G	R	3	0	H. J. Griffith.	S. B. Darlington, H. R. Guss, E. S. Darlington.
Wilkes-Barre	75,000	4.8	2	100	500	G	R	7	67	Frank Hochreiter.	J. G. Schuler, Supt.
Windber	10,000	....	....	15	2	G	R	1	1	S. H. Mills.	Banks Eakins, G. Butterbaugh, John Hartman, Dan Mills, Harry Deitz, R. M. Gouchnor.
Rhode Island—											
Central Falls	22,000	1¼	1¼	17	1¼	F	RD	2	16	C. A. Wilbur.	F. D. Frerman, R. C. Simmons, Peter Clare.
East Providence	20,000	15	3	200	2	F	...	2	5	C. H. Simmons.	H. T. Ray, H. R. Adams, R. G. McMeehan, F. E. White, W. Van Arsdell.
Newport	30,000	7¾	2¾	....	....	...	...	5	36	A. J. Kirwin.	
Woonsocket	40,000	8.3	....	....	....	G	R	5	50	A. J. Cote.	Frank Girard, Chmn.; Fred Burton, L. J. Archambault, J. F. Carroll.
South Carolina—											
Columbia	4,000	4.7	2	123	11	...	SD	3	44	W. J. May.	F. S. Earl.
Spartanburg	22,578	7	0.2	120	14	F	D	1	15	W. D. Mitchell.	J. F. Hudson.
South Dakota—											
Aberdeen	12,000	4	½	125	6	G	D	2	12	E. I. Kingsley.	S. H. Lynch, Comr.
Tennessee—											
Chattanooga	75,000	7	....	....	....	...	...	8	73	Wm. Toomey.	T. C. Betterton, Comr.
Clarksville	12,000	4	3	....	0	GF	S	1	3	W. E. Bates.	Chas. Perkins, Sam Hodgson, C. D. Runyon.

City	Pop.	Area Sq. Mi.	Area Fire Limits Sq.m	Mi. Streets	Mi. Paved Streets	Condition of Streets	Water Service	No. Fire Houses	No. Full-time Men	Name of Chief	Members of Fire Committee, Chairman Named First
Jackson	20,000	5½	0.2	....	3	F	D	1	10	B. L. Warlick.	Lawrence Taylor, H. M. Harris, Z. K. Griffin.
Johnson City	13,000	32	5	50	26	F	RD	2	3	Berry Wilson.	Frank Thomas, P. M. Ward, Albert Miller.
Nashville	125,000	18	9	342	204	G	R	17	121	A. A. Rozetta.	Geo. J. Tompkins, Comr.
Texas—											
Abilene	15,000	....	0.2	165	56	G	SD	1	2	J. J. Clinton.	J. N. Fergison.
Amarillo	17,000	8½	½	65	4	G	D	2	7	H. B. Jones.	W. H. Hardin, Cy. Mgr.; J. N. Beasley, Lee Bivins, W. E. Cazzell.
Austin	40,000	15	½	270	13	F	DR	8	33	C. L. Woodward.	W. B. Anthony, Dir. P. S.
Beaumont	35,000	6	0.6	81	34	G	D	5	40	E. E. Eastham.	J. J. Hogan, J. T. Booth, S. W. Pipkin.
Dallas	135,000	20	1½	342	153	G	D	14	176	H. F. Magee.	R. I. Winfrey, Comr.
Denison	20,000	4	1	....	20	G	SD	2	9	J. C. Cooper.	
El Paso	62,000	10	....	....	....	G	R	5	55	J. W. Wray.	W. G. Jolly, J. W. Fischer, J. P. O'Connor.
Galveston	48,000	6½	6½	155	18	GF	...	9	81	J. H. Gernand.	A. P. Norman, Comr.
Houston Heights	13,808	....	....	....	....	F	S	1	....	Hugh Montgomery.	M. L. O. Andrews, Mayor J. B. Marmion.
Laredo	22,000	....	....	....	....	F	D	2	3	C. C. Biggio.	J. P. Leyendecker, J. F. Westbrook, J. Maher.
Marshall	15,000	9	¼	....	16	G	SD	3	6	T. S. Coleman.	N. O. Sawyer, Comr.
San Angelo	15,000	7	....	150	2¼	F	SD	1	5	John Parker.	Eli Wells, Jr., Cy. Mgr.
Sherman	14,480	4	0.4	42	12	F	S	2	16	G. R. Hamblen.	City Manager.
Texarkana	20,000	5	1½	50	40	F	D	3	19	W. J. Springer.	W. K. Grim, A. W. Kennedy, J. D. Sanderson, R. P. Deerough, Gene Cook.
Wichita	17,000	9	....	87	9	G	DS	2	6	J. L. McClure.	M. J. Gardner, A. J. Richolt.
Utah—											
Ogden	30,000	16½	3	....	....	G	G	3	24	G. A. Graves.	A. R. Heywood.
Vermont—											
Burlington	22,000	6	6	65	....	G	R	5	27	C. D. Stockwell.	F. E. Perkins, N. Laury, E. F. Nash.
Montpelier	8,000	8	8	59	10	G	R	1	5	W. A. Pattee.	P. H. Ryan, H. C. Shurlteff, R. H. Standish.
St. Johnsbury	8,000	....	4	40	0	G	R	4	4	H. J. Marden.	
Virginia—											
Charlottesville	10,000	8	6	10	6	G	R	1	3	T. I. Williams.	Mayor.
Roanoke	52,000	7	....	....	....	F	D	6	57	Jas. McFall.	J. H. Stuart, J. F. Turner, Jr., A. Seubert, G. T. Kesler, A. W. Howard, T. D. Maslow, Wm. McDermott, S. O. Porter.
Staunton	15,000	....	....	48	12	G	R	1	12	J. M. Bratton.	L. C. Ware, G. W. Fretwell, S. P. Sillings, G. A. Cottrell.
Washington—											
Bellingham	36,000	23	1	165	40	G	D	3	14	J. J. Marsh.	Otto Hagen, E. C. Harshman, C. B. Wight.
Everett	12,000	....	0.2	....	6	G	RD	2	9	W. E. Crawford.	J. S. McKee.
N. Yakima	18,000	3½	1	90	12	G	D	2	18	E. G. Dawson.	J. F. Barton, Harry Coonse, Wilbur Crocker.
Olympia	10,000	6	½	20	8	G	RD	1	6	B. H. Barnes.	L. C. Ramberg, Geo. Talcott, A. Yauger.
Spokane	125,000	40	1¼	465	69	G	RD	14	146	A. L. Weeks.	Mayor, C. A. Fleming.
Tacoma	104,179	43	594	299	104	G	RD	12	112	C. E. Carlson.	F. H. Pettit, Comr. P. S.
Vancouver	12,000	20	20	....	....	...	RD	1	17	C. E. McCall.	J. J. Padden, G. R. Percival, E. H. Mackey.
Walla Walla	20,000	3.7	0.6	65	20	G	D	2	22	Wm. Metz.	Mayor, M. Toner.
West Virginia—											
Martinsburg	12,000	2½	1	30	1	F	D	4	5	Martin Quinn.	J. T. Wolford, T. M. Dunn, G. B. Wiltshire.
Moundsville	12,000	4	4	27	18	F	R	1	2	H. B. Haddox.	F. T. Moore.
Wheeling	.....	....	....	....	....	...	...	..	....		Lee Hedges, J. H. Zink, Jas. Richards, Thos. Fox, Edw. Vaas, J. J. Kenney, D. A. Morgan, Wm. Kieldsing.
Wisconsin—											
Antigo	8,000	1	0.1	....	....	B	D	1	7	E. Billings.	Mayor Calhoun.
Chippewa Falls	10,000	9	¼	65	3	F	R	1	7	Joseph Meuli.	Otto Detthoff, Erick Myrman, Joseph Sokap, A. H. Jasper, J. M. Morris.
Eau Claire	20,000	12	1	60	10	F	D	4	20	J. P. Webb.	Mayor John Barron.
Fond du Lac	20,000	6	0.1	80	25	20	D	3	25	Chas. Doll.	John F. Hohensee, J. J. Breister, L. P. Peake, and Mayor.
LaCrosse	32,000	10	1	....	43	G	RD	5	51	F. C. McGlachlin.	Frank Kohn, Paul Mahoney, H. Roth.
Menomonee	5,500	12	3	30	3	F	S	2	3	J. E. Johnson.	J. R. Mathews, F. W. Rowe.
Merrill	9,000	5½	0.1	50	5	F	D	2	9	Andrew Milspaugh.	Richard Kamke, John Moe, Chas. Canfield.
Milwaukee	448,000	26	8 1-3	600	400	G	SR	36	567	Thos. A. Clancy.	Aldermen Meisenheimer, Campbell, Baumann, O'Connor, Bohn.
Portage	6,500	....	....	20	2	F	...	1	4	C. L. Niemeyer.	M. J. Downey, F. F. Goss, John Studemeyer.
Sheboygan	30,000	6	2½	85	28	G	D	4	28	W. R. Trotter.	Edw. Fisher, J. C. Meyer, Oscar Schneiderwand.
Wausau	18,000	6¾	1	120	19½	F	D	4	23	F. F. Zeilsdorf.	F. J. Gaetzman, A. V. Gearhart, Louis Garske.



Mechanical Agitation and Aeration and Trade Wastes in the Activated Sludge Process

In connection with the presentation of the American experiments on activated sludge process of sewage purification at the October convention of the American Society of Municipal Improvements, the following account of recent English experiments will be of great interest. It is from a paper presented at the recent meeting of the Association of Managers of Sewage Disposal Works at Sheffield, England, by John Haworth, F. S. C., manager and chemist of the Sheffield sewage works.

These experiments, carried on at Sheffield, are by no means complete, and have been retarded on account of shortage of staff and pressure of work due to the war.

While the primary effluents from the contact beds are usually incapable of putrefaction, at times colloidal solids separate out on standing, and they are particularly liable to this effect on account of the large volume of trade wastes, containing iron and other metallic salts, hydroxides and mineral acids discharged into the sewers and present in the sewage at the outfall works. Experiments were, therefore, commenced about four years ago in order to determine the most suitable and economical methods by which these primary effluents from the contact beds might be rendered at all times satisfactory. The experimental plant consists of tanks, pump, motor, etc.

Aeration—It was found that, on standing in contact with air, opalescent and cloudy effluents became quite clear after about twenty-four hours. Experiments were, therefore, made to bring about, if possible, the rapid deposition of colloidal and other solid matters with subsequent clarification. These experiments consisted of (1) Aeration by jets of air, (2) Aeration by forcing air thru porous substances, such as land tiles and silica bricks. (3) Aeration by causing the liquids to fall in sprays. (4) Aeration by rapid treatment on percolating filters of varying depths. (5) Sand filtration. (6) Precipitation by chemicals. All these methods produced the effects desired to a greater or less extent, but by no means of the percolating filter effluents of high purity, clear and free from colloidal matters, were obtained. Primary effluents have been regularly treated in this manner at the rapid rate of 800 to 900 gallons per day per cubic yard of material with satisfactory results over a period of at least four years.

The following chemical results may be taken as typical:

	Parts per 100,000. Sprinkler effluent.
Oxygen absorbed, four hours' test*	0.68
Nitric nitrogen	0.72
Dissolved oxygen test. Oxygen absorbed in five days at 18.3 deg. Cent.	0.63
Suspended solids	Traces only

*Liquid treated, 2.51.

The effluent, when diluted with tap water in the proportion of four effluent plus five tap water and the mixture aerated at 14.5 deg. Cent. (equal to two parts dissolved oxygen per 100,000) and then incubated for five days at 18.3 deg. Cent. invariably absorbed less than two parts of oxygen per 100,000, and was, therefore, well within the Royal Commission standard.

Whilst the early experiments which were made by forcing air thru porous substances, such as land tiles and silica bricks, did not yield such hopeful results, there was an incentive to continue the experiments, inasmuch as attention had then been drawn to the use of activated sludge in combination with aeration. Consequently, it was thought that useful information might be obtained by applying activated sludge to the treatment of primary effluents. In two of the experimental tanks, fitted with diffusers, sludge was activated by the usual method. In one tank primary effluents and mixtures of these effluents with settled sewage were dealt with, and in the other settled sewage was treated. The results have proved both interesting and instructive. In the case of the tank treating primary effluents with settled sewage, deposition of colloidal matters is obtained, but bearing in mind the large volumes of this liquid which can be dealt with on the percolating filter and the greater simplicity of the process, no advantage would be gained by adopting the former.

Briefly, the following are the results arrived at: (1) Well-clarified effluents are usually obtained which are within the commonly accepted limits of impurity allowable. (2) It is found that discharges of acid trade wastes, such as occur in the Sheffield sewage, destroy the efficiency of the sludge for a time. On one occasion a particularly strong discharge resulted in the activity being destroyed, and aeration for several weeks was required before clarified effluents could again be obtained. This inhibitory action is more or less pronounced, and, consequently, great care is necessary to render such abnormal discharges neutral in character and to equalize their flow so as to render such sewage amenable to purification by this process. A still more important point must be considered, namely, the effects of discharges of trade effluents containing and consisting essentially of chemical solids of heterogeneous composition upon the activated sludge. (3) The porous tiles became choked after a few months' use, owing to dust and grease in the compressed air, and also by bacterial masses growing thru the pores of the tiles. This latter fact has also been proved in connection with the Pasteur-Chamberland porous porcelain tube filter. (4) Uneven aeration occurs by reason of unequal porosity of the tiles. (5) Tiles have cracked, with the result that the air escapes at one place, and the tank has had to be stopped for repairs. This unsatisfactory feature in the use of porous tiles requires serious consideration. These unsatisfactory features lead one to the conclusion that, while sewage may be purified by means

of activated sludge, the mode of application leaves room for much investigation and improvement before its practical utility is proved. Experiments have, therefore, been made in connection with devices for the aeration of liquids without the use of porous media, and in this direction some of the latest experiments will now be described.

During a discussion on this question with Mr. F. Scudder, F. I. C., F. C. S., of Manchester, he described to me a series of experiments on the aeration of crude sewage which were made by him in 1881, in collaboration with the late Dr. Angus Smith, and called my attention to an apparatus designed for the oxidation of oils, etc., devised in the year 1880 by Dr. Storer, and which was used in Angus Smith's experiments. As a result of this, and with the aid of valuable suggestions by Mr. Scudder, apparatus has been constructed which promises satisfactory results, of which several small types may be seen in operation. The apparatus consists essentially of a narrow cylindrical tube placed vertically and fitted with a central spindle, bearing either an archimedean screw or a series of suitably shaped propeller blades. A number of the blades are within and others projecting below the lower end of the tube. The top of the cylindrical tube is placed at a suitable depth beneath the surface of the liquid to be aerated. On rotating the spindle at a rapid rate the liquid is merely circulated down the cylindrical tube, but on the insertion of a small air pipe within the edge of the cylindrical tube a large volume of air is sucked in and distributed into the liquid at the lower end of the cylinder. The mixed water and air rise up on the outer side of the tube ready to flow in again, and thus the aeration is continuous. The apparatus is at present experimental in character, but, as a mechanical means for circulating the sludge and at the same time giving abundant aeration, has so far proved to be simple and effective without many of the disadvantages to which aeration by forcing of compressed air thru porous slabs, etc., is liable.

It should be observed that two functions are performed by the air in the activated sludge process as now operated, viz., primarily, the supply of oxygen for maintaining the bacteriological and chemical action and efficiency of the sludge; and, secondly, the agitation of the sludge with the liquid. As only a small proportion of the air is used for oxidation, and the larger proportion for circulation, it becomes questionable whether it is economical to use compressed air for purposes of agitation, or if mechanical agitation, which would carry in probably the minimum amount of air necessary, would work as efficiently as the more expensive compressed air plant.

With this aim two further experiments were devised: (1) A series of perforated ordinary steam pipes was laid at the bottom of a small tank and connected to the compressed air supply. Over the pipes approximately 2 feet of clean clinker or slag broken into approximately ¾-inch cubes was laid. The tank was then filled with settled sewage and air bubbled thru for about five hours. The resulting effluent was found to be clarified, non-putrescible, and in all respects a satisfactory one. A partially septic and black tank liquor treated by this method becomes bright and clear after one hour's aeration, and after four or five hours is amply purified. One of the tanks has been in daily operation for about nine months and continues to give good results.

	Parts per 100,000. Effluent.
Oxygen absorbed, four hours' test*	0.92
Nitric oxygen	1.15
Dissolved oxygen test. Oxygen absorbed in five days at 18.3 deg. Cent.	1.89
Suspended solids too small to estimate in 250 c. c. of liquid.	

*Liquid treated, 4.97.

The effluents when diluted with tap water in the proportion of four effluent to five tap water, aerated at 14.5 deg. Cent. and then incubated for five days at 18.3 deg. Cent., with a few exceptions absorbed less than two parts of oxygen per 100,000, thus being within the Royal Commission standard.

(2) The second experiment consisted of a small iron tank having a semi-circular section at the bottom. A shaft was fixed lengthwise thru the tank, and to it were attached two hollow paddles of special shape, so arranged that in the lowest position the paddle nearly touches the bottom of the tank, and in the upper position it is approximately at the top of the tank. The tank was charged with humus washed from material taken from a contact bed together with sewage, the proportionate volume of humus being 25 per cent. of the sewage. When the paddle is rotated the blades leave the liquid at the surface and trap a small volume of air, which is carried into the liquid and discharged therein. Thus the mixture of humus and sewage is kept continuously in motion and a definite quantity of air is discharged into it by each revolution of the paddle. The paddle is revolved fifteen times per minute. After several weeks' operation the humus was found to become fully activated, and during the last six months crude sewage has been treated daily with satisfactory results, as the analytical table indicates:

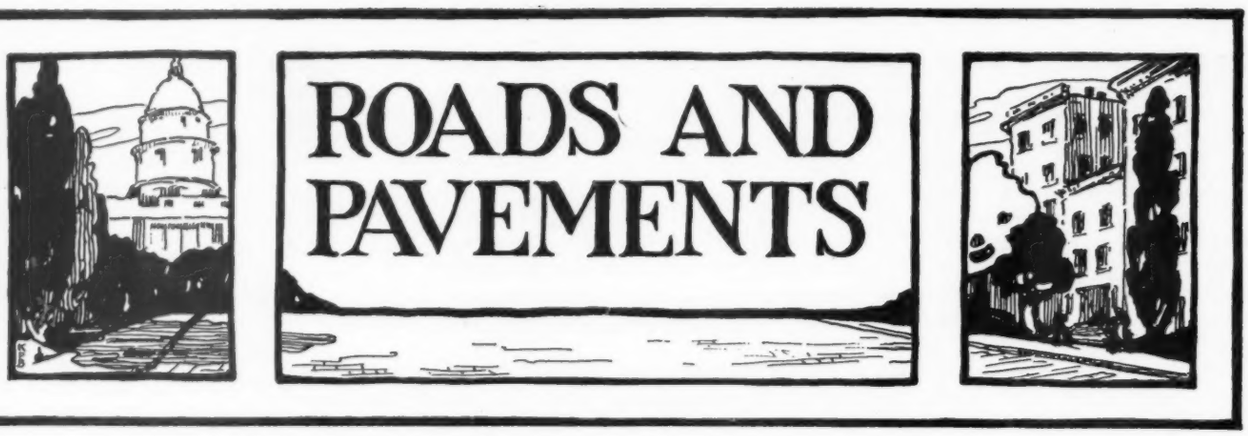
	Parts per 100,000. Effluent.
Oxygen absorbed, four hours' test*	1.17
Nitric nitrogen	0.66
Dissolved oxygen test. Oxygen absorbed in five days at 18.3 deg. Cent.	0.57
Suspended solids too small to estimate in 250 c. c. of liquid.	

*Liquid treated, 4.81.

The effluents, when diluted with tap water in the proportion of four effluent to five tap water, aerated at 14.5 deg. Cent., and then incubated for five days at 18.3 deg. Cent., invariably absorbed less than two parts of oxygen per 100,000, thus being with the Royal Commission standard.

The results of these two experiments show that the aeration by minute bubbles of air, such as thru porous tiles, is unnecessary, and that the mechanical circulation, combined with minimum aeration, is efficient. Both these experiments are still in operation.

The general conclusions drawn from the experiments which have been described may be summarized thus: (1) That a normal sewage may be purified by the activated sludge process. (2) That trade wastes may interfere seriously with the process. (3) That further investigation is needed with respect to modes of application of the sludge to the sewage, periodical removal of the surplus sludge and the effect of such removal on the continuing results of purification methods of aeration, costs of plant and upkeep, before older plants and methods can be abandoned. (4) That skilled control of the process will be essential. (5) That while the resulting sludge is undoubtedly richer in nitrogenous organic matter than ordinary sewage sludge, it remains to be proved by actual agricultural trials that such nitrogen is in a form suitable for the ready assimilation by plant life, and that as a fertilizer its superiority over humus can be established, as up to the present humus sludge derived from sprinkler filters, which is also richer in nitrogenous organic matter than ordinary sewage sludge, has not been appreciated by the agriculturist as a fertilizer, in spite of its availability in large quantities at many sewage works in this country during recent years.



Efficiency and Economy in Road Construction

By W. H. Reed.

The main highways of a county should be paved first. The paving of any feeders before the main arteries are paved means the sacrifice of the welfare of the many for the benefit of the few. Therein is vested the essence of good or bad government. Wherefore, a board of county commissioners should not permit themselves to be swerved by any group pressure or "my district's interest" or vote promises or vote threats from first paving the main highways. Very few are seeking the general welfare at a sacrifice of their individual, selfish interests. Otherwise good government would not be so remote.

The township system for road construction is a most serious obstacle to the paving of the main highways first. I consider it bad from every viewpoint: Self-centered, multiplies supervisory powers, which makes for greater cost and inferior work; increases nepotism and favoritism in the construction crew. Fortunately, Spokane and Whatcom counties are the only ones in the State of Washington having the township system. It's a relic—primitive. The district plan prevailing in Washington is bad enough.

Efficient Officers of First Importance.

The annual outlay for pavements by five states in 1915—not counting county and city expenditures for pavements—was, approximately, $26,000,000. Complete figures for all the states are not obtainable. In such enormous expenditures there is an opportunity for great loss. There is such loss. Why? Inefficiency; lack of thoroness. All standard types of pavement are good if properly constructed. All are bad if improperly constructed. Any standard type of pavement, thoroly well maintained, should last twenty years or more. If thru faulty materials, specifications or workmanship such life is reduced one-half, as frequently occurs, as does occur on the average, then the public loss in the United States is no less than $50,000,000 per annum.

Hence, obviously, the thing to do of first importance to avoid such misfortune is to elect officers who are to have supervision of the paving work on the basis of efficiency. If you of Oregon put your men in office on that basis, you vote on a different basis from that of any other state in this Union. I know that when I was elected county commissioner of Pierce county, Washington, I displayed a lack of ability in certain directions amounting almost to genius. In my statements to you Oregonians I wish to avoid being too realistic, but the truth is, my ignorance on some questions did, because of my chagrin, make me perspire.

Our Intelligent Method of Selecting Officials.

In Washington we vote for the candidate on the following basis: First, because he belongs to "our party," which may be, fortuitously, a Republican, Democratic, Bull Moose, Moonshine or Evergreen party. Second, and commonly a close second, too, we vote for the candidate because he belongs to or will favor our church, or because he is anti-church; or will favor our lodge, or grange, or union, or Spanish war veteran organization, or "is good looking," or "speaks to our baby." The surprising part in it all to me is not that the result is so bad, but that it is not much worse. If railroad companies, manufacturing plants or any other business organizations chose their managing men on a similar basis, they would "go broke" in short order. You may think I have strayed from the pavement part of my subject. I haven't. In your public officer exists an essential, the necessary foundation, for good pavements. It may be futile to order water to run uphill, but it is no more so than to expect the uninformed to intelligently direct.

Trained Consideration of Paving Types.

If you have selected your officials, engineers, county judges and commissioners, on the basis of efficiency, such officers will consider the paving question somewhat along the following lines:

First: Creosoted wood blocks and brick pavements cost most. Does the country road traffic warrant such expenditure? Next in cost come, in the following order, bitulithic or warrenite, sheet asphalt, bitucrete, cement concrete. Does the traffic census, taken on the proposed highway, warrant the construction of any one of these pavements?

Second: Which of these pavements is the most durable and would have the lowest maintenance cost? These officials would know, having been elected on the basis of efficiency, that brick pavements, properly constructed with first-class paving brick, will last, because they have lasted, twenty-five years; and that the yearly maintenance expenditure on such type of pavement for country traffic would be about $100 per mile.

Sheet asphalt: They would know by service test that a properly built sheet asphalt road is good for twenty-five years' wear, with a maintenance cost of about $100 per mile per year; that in every way it is a first-class pavement for country roads if properly built, with but one drawback—that of slipperiness under a light rainfall. This defect we have remedied in Pierce county at an additional expense of 6½ cents per square yard, by covering it with "roadamite," ¼ gallon to the square yard, heavily sanded with coarse torpedo sand.

Warrenite or bitulithic: This patent was issued in 1903, and, therefore, there is no service proof that it would last twenty-five years; but these officials would be able to reach a fairly well-founded conclusion on the basis of performance of various well-constructed examples of this type, to the effect that it would probably last twenty-five years, their chief doubt arising from its tendency to disintegrate by reason of bleeding, its volatile oils being drawn to the surface by capillary attraction of the sun. Its annual maintenance cost would be $100 per mile.

Bitucrete: This type of pavement has not been construct-

ed long enough to afford a reasonably fair basis for a conclusion as to the life of its wearing surface. Its cement concrete base is certain, if properly constructed, to be good for many more than twenty-five years, which should also be said of a bitulithic or warrenite pavement having a cement concrete base.

Cement concrete: With the exception of the concrete pavement, 10 feet wide and 220 feet long, built in Bellefontaine, Ohio, in 1893-4, which I do not consider adequate evidence, there has not been built any cement concrete pavement for a sufficient number of years to enable any one to know that its surface wear is good for twenty-five years. In my opinion it isn't, no matter how well constructed, so long as there is any considerable number of iron-shod wheels used on vehicles. We know that cement concrete becomes gradually harder with age, extending on for many years, very slowly after the first thirty days, with a gradual increase in the slowness of additional hardness. When the surface wear by abrasion requires a covering of sheet asphalt, bitulithic or warrenite, bitucrete or a blanket coat, then we have in the cement concrete pavement, without additional cost, the best known base. The maintenance cost of a cement concrete pavement without asphaltic surfacing would be about $50 per year per mile. Tho, in Pierce county our best built cement concrete pavements have had a maintenance cost, on one of six miles, of $22 per mile per year, and on another, a six-mile extension of the same road, of less than $9 per mile per year so far. The first-named six miles was built in 1913; the second-named, better specifications and a little better workmanship, in 1914.

Third: These capable commissioners, having reached this point in their reasoning on the pavement problem, will begin to figure interest on the investment in each, with the above basic factors before them, in about this way: If one type costs two and a half times more than another, the interest on the more expensive type will be two and a half times greater; hence the lower cost pavement, if it is certain to last half as long and its maintenance cost has proven to be no greater than that of the more costly type, would undoubtedly be the better investment. If the lowest cost pavement is certain to have a surface wear one-half as long as a type costing one-half more to construct and its yearly maintenance cost is about one-half that of the other, and it is known in addition that when the lower cost type should require an asphaltic wearing surface there is in hand the best-known base for such surfacing, then, logically, these officials will at this point, ask themselves: Why not save the interest on the cost of the asphaltic surfacing for all these years up to the date when such surfacing is required?

You will notice that I have not mentioned for consideration the water-bound macadam type; nor the type bound by asphalt under the penetration method. My reason for overlooking these types was that I am reasonably sure your commissioners, whom you have elected on an efficiency basis, would know that with the advent of the automobile with its speed suction these types were no longer to be considered; that their construction cost, 16 feet in width, would be $7,000 to $9,000 per mile, with a *maximum* life, if properly constructed, of three years; whereas, a cement concrete pavement, properly constructed of same width would cost but from $9,000 to $12,000 per mile, have a minimum wearing-surface life of seven years by service test and would afford a base good for 100 or more years and a maintenance cost of seven-eighths less than any type of macadam.

Are Constructing Pavements Fast Enough.

When the hard-surfaced roads now under construction in Pierce county, Washington, are finished, we will have 62.44 miles of paved roads; being 22 miles of cement concrete pavements, 17.14 miles of bitulithic, 8.47 miles of sheet asphalt, 8 miles of granitoid, 6.06 miles of bitucrete, 0.75 miles of brick. These pavements are all 16 feet wide. The bitulithic average cost, exclusive of subgrade, was $12,918 per mile; sheet asphalt, $12,251; bitucrete, $12,101; granitoid, $13,143; brick (No. 2), $16,791; cement concrete, $8,026.

Pierce county hasn't any road bonded indebtedness. Nor has the state of Washington—Thank God, and Governor Lister!—nevertheless, Washington is fourth in the Union in country pavement mileage, with California third. In my opinion, we are building our pavements fast enough. We will all know better how to construct pavements within the next five years. There is much yet to be learned in pavement construction. We will know far more of the chemistry of materials within the next five years. On pavement construction, we are just waking up. I believe we will make progress faster by going slower.

The people of Washington are now and have for several years been taxed about $7,000,000 per year for state and county highway construction and maintenance in addition to an aggregate of approximately $5,000,000 in county road-bond issues.

The state of Oregon expends, approximately $235,000 each year, from the state fund, on road surveys and construction. The counties of Oregon spend on roads, per year, about $4,000,000, not figuring the bond issues of $400,000 for Clatsop county; $375,000 for Columbia county; Hood River, $75,000; Multnomah, $1,250,000; Jackson, $400,000, and $362,000 for Coos county; all these voted for within the last three years, and all these funds expended in construction, excepting those of Coos county, which were but recently authorized.

Standard Form for Making Traffic Counts

The importance of the traffic census in the design of street pavements is now generally recognized. The report upon a standard form, made to the American Society of Municipal Improvements by a committee of which J. C. Hallock, of Newark, N. J., is chairman, is therefore very timely. The standard form was adopted after a careful study of the methods and forms of report used in the eight or ten cities which make traffic counts and represent the best practice at the present time.

Newark makes regular census counts once in 3 years, Baltimore, Brooklyn, Buffalo and St. Louis make them annually and Philadelphia every 3 months. The count is made for 3 days at each point in Buffalo and for 4 days, Friday to Monday, in Philadelphia.

The form of blank for keeping count which is adopted by the American Society of Municipal Improvements is headed "Traffic Census Observation Report, ——— City, ——— department; with spaces for statement of direction of travel, street on which count is made and between which it is passing; date; weather; name of observer; kind of pavement; and condition of pavement, whether clean or dirty, damp or dry, slippery or safe. The columns are headed for the hours from 8 a. m. to 7 p. m., with two blank columns for later observations if desired.

The traffic is divided into classes with one line for each subdivision:

1. Iron tired vehicles; 1-horse vehicles, light and heavy, 2-horse vehicles, light and heavy, 3 or more horse vehicles, and total.
2. Street cars.
3. Rubber tired vehicles; motorcycles or bicycles; passenger vehicles, 2-passenger, 3 or more passenger; freight vehicles, large loaded or empty, small loaded or empty, and total; and grand total.

The blank thus has 16 lines for making records and 13 columns.

For card records a form is provided for each street on

which count is made and each pair of streets between which the traffic passes which is counted.

All the counts made at a given point are entered on one of these cards so that the traffic at different dates can be counted directly. The columns are headed: Date, Kind of Pavement, Date Laid, Width of Road, Wet or Dry, No. of Hours; the vehicle data are given in Total per day for Horse, Motor and Total; Average per hour for Horse, Motor and Total; Maximum per hour in Number and Hour; Average per minute per foot width of pavement for Traveled Width and Total Width; the tonnage data are given in Total per Day, Average for Vehicle, Average per minute per Foot Width of Pavement, and Total per year per Foot Width of Road; there are columns also for per cent. of traffic Horse and Motor, for Number of Street Cars, and for Traffic Units per Minute per Foot Width of Road.

Good Roads Notes

New Jersey is considering the passage of a law authorizing the issue of $7,000,000 to pay for the construction of thirteen main thru highways and proposes to pay off the principal and interest out of the fees for motor vehicles. These amount now to $1,500,000 a year and increase about 25 per cent. each year. This novel plan for paying for this reconstruction seems equitable, especially so far as truck travel is concerned, since it is made necessary by the enormous increase in number and weight of such vehicles using the main roads.

New Paving Scheme in Georgia

By J. B. Ansley, City Engineer and Supt. Water Works, Americus, Ga.

The city street force, composed of convict labor, under the direction of the writer, is laying considerable concrete street pavement in the residence section of the city of Americus, Ga.

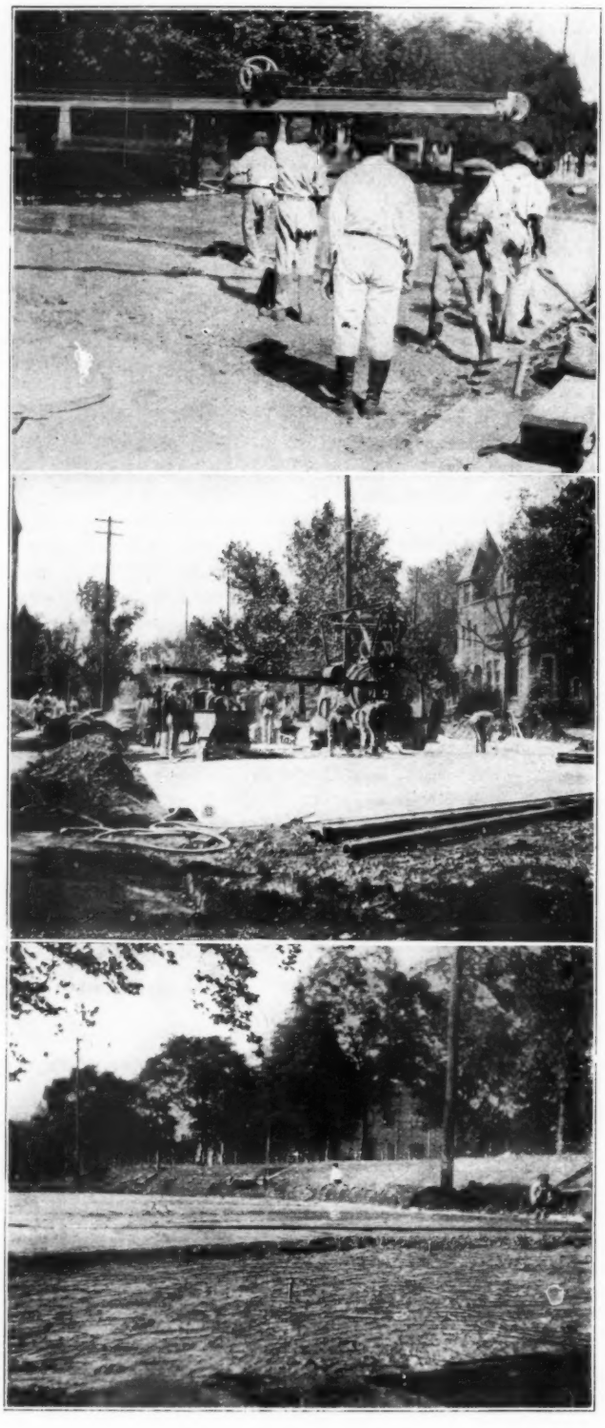
As an inducement the mayor and City Council have agreed to do the grading, hauling, mixing and laying of pavement free of cost to the propertyholders on condition that the property owners pay for the material constituting the pavement. As a result several residence streets are being paved. It is stipulated that 60 per cent. of the property owners must petition the mayor and City Council to pave the street upon which their property abuts before any street can be paved, and, upon the compliance with this rule, an ordinance is passed granting the request and work of paving commenced within thirty days.

The class of pavement is a 1-2-3 mix, one course concrete pavement; 5 in. thick at the curb line and 7 in. thick in the center, with a crown of 6 in., reinforced with American Steel & Wire Company 29R triangular mesh wire. ½x5-in. Elastite for expansion joint along curb and two thicknesses of one-ply tar paper (left ½ in. under surface) for transverse joints spaced 35 ft. apart, street widths varying from 35 to 40 ft.

The concrete is being mixed and placed with a No. 16 Koehring paver equipped with 20-ft. boom and bucket and gasoline engine, owned by the city. The surface of the pavement is finished by rolling while green with a light hand roller and dragging off with ¾-in. rubber hose. An average of 500 sq. yds. per day is the progress made. As stated, the city is doing the work of grading, preparing of the sub-base, hauling off all the material and mixing and placing concrete with its regular street force of teams and convict labor, free of cost to the property owner; but the entire cost of the material for the pavement is paid for by the property owners abutting, one-half being assessed against owners on either side of the street paved, the city itself paying for all street intersections. The city is not put to any extra expense for this work, regarding it as an actual economy in that every street so paved relieves the force of the maintenance of that street as a sand-clay proposition. Besides that, the residences along the paved thorofare are relieved of the dust nuisance from automobile and other vehicle traffic. The approximate cost to the property owner is $1.00 and to the city 25c per sq. yd.

We find that the convict labor employed in street paving and other work is more efficient than ordinary free labor, inasmuch as the convicts are more careful to carry out instructions and more interested in the work than is usually the case with free laborers.

The accompanying photos give a fairly clear idea of the methods employed in the placing and finishing of the pavement.



MISCELLANEOUS

Meetings of Organizations

Dec. 11-13, at New York. Portland Cement Association.

Dec. 14, 15, at Syracuse, N. Y. Conference for Better County Government in the State of New York. O. E. Cartwright, 15 Court street, White Plains, N. Y.

Dec. 26-28, at New Haven, Conn. Society of American Bacteriologists. Dr. A. P. Hitchens, secretary, Glen Olden, Pa.

Dec. 26-31, at New York. American Association for the Advancement of Science. L. O. Howard, secretary, Smithsonian Institute, Washington, D. C.

Dec. 27, 28, at Tulsa, Okla. Oklahoma Society of Engineers. H. G. Hinckley, secretary, Oklahoma City.

Dec. 27-29, at Columbus, O. American Statistical Association, American Economic Association and American Sociological Society. Prof. Carl E. Perry, Ohio State University, Columbus, O., chairman of local committee on arrangements for the joint meeting.

Dec. 27-29, at Chicago, Ill. American Society of Agricultural Engineers. D. K. Shedd, secretary, Ames, Ia.

Dec. 28-31, at Cincinnati, O. American Political Science Association. C. L. Jones, secretary, University of Wisconsin, Madison.

Dec. 29, in assembly hall of the Automobile Club of America, New York City. Conference on road engineering education, under auspices of the Society for Engineering Education, American Association for the Advancement of Science, National Automobile Chamber of Commerce, Automobile Club of America and National Highway Association.

Jan. 20, 1917, at Kansas City, Mo. Western Paving Brick Manufacturers' Association. G. W. Thurston, secretary, 416 Dwight building, Kansas City, Mo.

Jan. 23-25, 1917, at New York. American Wood Preservers' Association. F. J. Angier, secretary, Mt. Royal Sta., Baltimore, Md.

Feb. 7-19, 1917, at the Coliseum, Chicago, Ill. Tenth Cement Show.

Feb. 8-10, at La Salle Hotel, Chicago. American Concrete Institute. H. D. Hynds, secretary, 30 Broad street, New York.

Feb. 12, 13, at Sherman Hotel, Chicago, Ill. National Builders' Supply Association. L. F. Desmond, secretary, 1211 Chamber of Commerce, Chicago, Ill.

Municipal Bond Market

The sales of municipal bonds in October were four million dollars greater than in any previous October, being $37,898,233. The next highest sales figure was in 1913, and this class has now fully recovered from the effects of the war. This is true as to price as well as volume of sales, and bonds are now getting back toward the level of 1905, when the 3½ per cent. bonds of the larger cities sold at a premium. The net income basis now is well below 4 per cent. *The Bond Buyer* is the authority for these statements, and that periodical pays special attention to municipal bonds of all kinds, as they are now the most popular form of long-time investments.

American Steel Pipe

A recent article in an English paper devoted to the iron trade goes into considerable detail in comparison of American and English welded steel pipe used in pipe lines in Egypt, very much to the credit of American pipe. The points of advantage of American pipe are the standardization of sizes in the smallest number possible, the larger threads by which joints are joined together, the better protection of these threads in shipment, the better design of these junctions, all of which result in better pipe, pipe more easily and safely handled, and a very material reduction in cost, notwithstanding the much higher cost of American labor. One very material advantage as to cost of pipe in place is found in the American system of using one class of pipe for all uses, whether gas, steam or liquid under pressure, the only differences being for differences in pressure to which the pipe is to be subjected, and none being made for differences in material carried.

Modern methods of welding add enormously to the availability and applicability of steel and wrought-iron pipe, since now any sort of connection can be made successfully and any kind of bends or twists, without fear of leaky joints. Electric, blowpipe and thermit welding are all used, and the welded pipes can be made quite as flexible and strong as the original short lengths of pipe, 20 feet each, approximately.

Some very interesting examples of pipe welding by the various processes are shown and described in Bulletin 26 of the National Tube Company, of Pittsburg. The processes are applicable to the joints of pipe laid in water, gas or steam lines in trenches or conduits.

To protect the pipes from corrosion they are very carefully coated. The pipes are made of a special soft steel having a very high degree of uniformity, and are Spellerized by a process of hot forging during manufacture, which makes the surfaces more uniformly dense and resistant to pitting. This steel pipe, cleaned and dried and still above the boiling point of water in temperature, is dipped into a special refined bituminous compound and kept there until its temperature is brought up to that of the bath. Then the enamel-like surface is wrapped with a strip of fabric, thoroly saturated with the hot compound, being wound round spirally with about an inch overlap on each turn, the thickness of one-ply coating being about 3/64 inch, as compared with 0.01 inch or less thickness of the ordinary bituminous coating. For special difficulties in transportation, handling or use the coating can be applied in as many thicknesses as may be desired. The machinery for wrapping the pipe makes a very ingenious application of mechanical principles. It is shown in another booklet of the National Tube Company.

Outline for the Study of Bitumens

Arranged in convenient question and answer form with space for additional memoranda, The Barber Asphalt Paving Company has published an "Outline for the Study of Bitumens." While the whole subject of bitumens is covered, the Outline has been prepared with especial reference to the asphaltic materials used in highway construction. In addition to the answers provided in the Outline itself, there are references to most of the standard text books on highway engineering. While prepared especially for school use, the Outline is a convenient means of reference for anyone who finds it necessary to investigate the differentiation and characteristics of bitumens.

Commission-Manager at St. Augustine

In 1915 the new charter of St. Augustine, providing the commission-manager form of city government, was adopted by a majority of but 18 votes. Since that time there has been much criticism of the form of government by those interested in retaining the former system, but notwithstanding much activity of this sort, the candidates for the city board pledged to the present form, with slight modifications, were elected by a vote of more than 2 to 1, the average majority of the candidates being 329. The present commissioners, up for reelection, led the ticket, showing that the criticisms were not those of the people at large.

Civil Service Examinations

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

Dec. 5: Associate ceramic chemist in the Bureau of Standards, Pittsburg, Pa., at $2,000 to $2,500 a year.

Dec. 11: Designing engineers in Bureau of Yards and Docks, Navy Department, Washington, D. C., at $10 to $15 a day.

Dec. 13, 14: Assistant inspector of weights and measures, in Bureau of Standards, Department of Commerce, for field work, at $1,000 to $1,600 a year. Assistant engineer, inspector of weights and measures, same office, same salary. Laboratory apprentice, same office, at $480. Structural engineer and draftsman, supervising architect's office, Treasury Department, at $1,600 to $1,800 a year.

Personal Notes

Charles L. Pillsbury Company, consulting engineers, of 805 Metropolitan Life building, Minneapolis, Minn., and 716 Capital Bank building, St. Paul, Minn., are now associated with Vaughn & Meyer, consulting engineers, 1007 Majestic building, Milwaukee, Wis., and together cover a wide range of engineering activities. Mr. Vaughn will have his headquarters in Milwaukee, and Mr. Pillsbury and Mr. Meyer will have headquarters in Minneapolis. There are no changes in designations of firms.

Manley Osgood, city engineer, Ann Arbor, Mich., has formed the Washtenaw Engineering Company, of which he is president, which will devote itself to the various lines of municipal engineering and accounting and surveying, with offices at 408 First National Bank building, Ann Arbor.

Sanford E. Thompson, consulting engineer, especially in reinforced concrete, steel, and economical plant operation, has combined his offices at Newton Highlands and Milk street in one which he has located in the Federal Street building, Boston, Mass. Mr. Thompson has full laboratory facilities.

Technical Schools

By a co-operative arrangement with the International Railway Fuel Association the United States Bureau of Mines and the Railway Engineering Experiment Station of the University of Illinois, a series of tests of various sizes and grades of coal for fuel is in progress and the Baltimore & Ohio Railroad has loaned a new Mikado type locomotive for testing the fuels under conditions of actual use of Illinois coal from 2 by 6 lump to impalpable powder, one study being of the relative smokelessness of the methods of burning the coal.

The fourth annual short course in highway engineering at the University of Illinois will be held January 8 to 19, 1917. The program will include men well known in the field of highway engineering. There will be courses in continuation of the work of last year, as well as for those coming for the first time. No fees and no examinations.

Association Notes

At the annual meeting of the American Road Builders' Association, held in New York November 3, announcement was made of the election of Arthur W. Dean, chief engineer Massachusetts State Highway Commission, as president; W. H. Connell, A. B. Fletcher, A. H. Blanchard, vice-presidents; E. L. Powers, secretary; W. W. Crosby, treasurer; T. R. Agg, W. E. Atkinson, F. E. Ellis, R. H. Gillespie, B. Michaud, Paul D. Sargent, directors for three years. At the following dinner about 100 members and guests were present.

Publications Received

Bulletin 90 of the Engineering Experiment Station, University of Illinois is on "Some Graphical Solutions of Electric Railway Problems" and is by O. M. Buck.

Clifford Richardson's paper before the Western Society of Engineers at Chicago, November 20, 1916, on the "Importance of the Relation of Solid Surfaces and Liquid Films in Some Types of Engineering Construction," has been issued in an 8-page pamphlet.

Progress reports of experiments in dust prevention and road preservation in 1915 are printed in Bulletin 407 of the U. S. Department of Agriculture, being a professional paper from the office of Public Roads and Rural Engineering.

The first number of *The County Commissioners' Magazine*, published at Milwaukee, Wis., has been received.

Reprint from Journal of Agricultural Research of paper by Charles S. Reeve and Fred P. Pritchard on a new penetration needle for use in testing bituminous materials.

Glimpses of our National Parks are given in a booklet with that title published by the U. S. Department of the Interior, Washington, D. C.

Elements of Highway Engineering, by A. H. Blanchard, professor of highway engineering, Columbia University. John Wiley & Sons, New York.

Engineering as a Career, a series of papers by eminent engineers, edited by F. H. Newell and C. E. Drayer. Cloth, 226 pp., $1. D. Van Nostrand Co., 25 Park Place, New York.

City Planning; a series of papers presenting the essential elements of a city plan, edited by John Nolen. Cloth, 447 pp., $2. National Municipal League Series, Appletons, New York.

Regulation of Railroads and Public Utilities in Wisconsin, by Fred L. Holmes. Cloth, 375 pp., $2.16 by mail. Appleton's Railroad Series, D. Appleton & Co., 35 West 32d street, New York.

The Carnegie Library of Pittsburg has issued a 42-page booklet, giving a bibliography of books and magazine articles on "Road Dust Prevention."

A paper on the concrete road by Edward N. Hines, chairman of the board of county road commissioners of Wayne county, Mich., read before the Portland Cement Association meeting at Detroit is in one of the series of booklets issued by the Portland Cement Association, 111 West Washington street, Chicago, Ill.

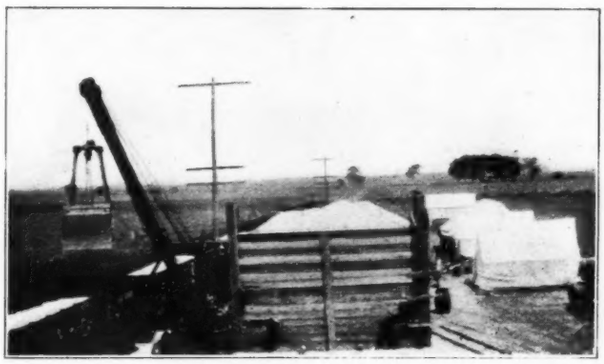
MACHINERY AND SUPPLIES

Self-Propelling Grab-Bucket Crane, Excavator and Unloader

The "auto crane" shown in the accompanying illustrations has been built for adaptation to a wide variety of construction purposes, including excavation, ditch-digging, back-filling and the loading and unloading of gravel and similar bulk material at a time-saving over hand methods. For road work the machine has a notable use in transferring stone from cars to bin as is shown by the photograph, which was taken on a Vermillion county, Illinois, job, for which the P. M. Johnston Company, of St. Elmo, Ill., was the contractor.

The other illustration shows how F. C. Theselius, big Chicago contractor, uses the "auto crane," which he says is "the only unloading machine allowed by railroads here on public team tracks."

The total weight of this traction derrick is 19,500 lbs. It has a lifting capacity of 4,000 lbs. and dimensions that bring it well within highway and railway clearances, so that it may travel almost anywhere that a motor truck can go. The boom can easily be lowered and the stack removed for close clearances.

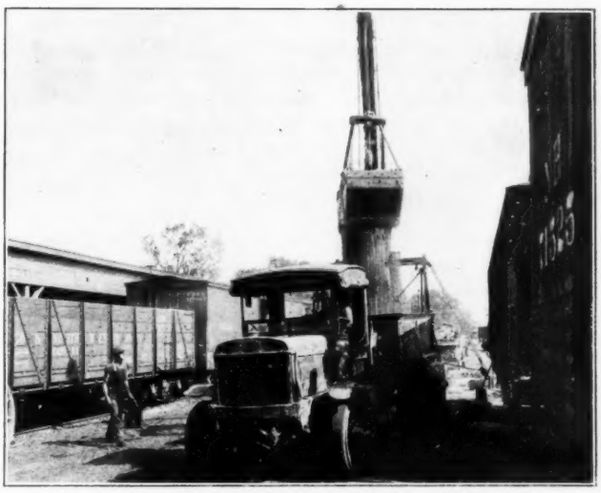


UNLOADING GRAVEL FOR VERMILLION COUNTY, ILLINOIS, ROAD WORK.

The 4-wheel car body is 17 ft. 4 in. long by 6½ ft. wide, with a 15-ft. 4-in. wheel base and a height from ground to top of A-frame of 12 ft. Either a ½-yd. clamshell or a 12-ft. orangepeel bucket can be used at the end of the 20-ft. boom.

The forward or propelling wheels are 39 in. in diameter, with 10-in. face and ¾-in. tires. On these wheels are sprockets driven by a heavy steel pintle chain. There is also a differential. The steering wheels are 30 in. in diameter and are mounted on a pivoted axle and steer by handwheel and worm. An emergency hand brake is provided. The wheels are drilled for attaching spuds, if desired. The propelling speed forward or reverse is 200 ft. per min.

The machine is built with three power friction-drums for use with clamshell or orangepeel. Where the outfit is used



LOADING MOTOR TRUCK ON RAILROAD'S PUBLIC TEAM TRACK.

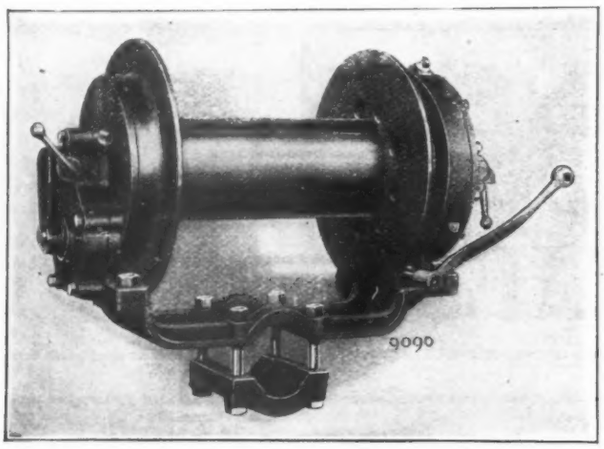
only as a derrick, the same frame is employed with but two power drums, space being provided for a third drum, so that the extra drum can be added in the field, if desired. Housing is provided in the form of an all-steel cab.

The boom is an 8 by 10 stick having a three-rod steel truss the full length. For sand, gravel, screenings and similar loose material almost any light standard bucket is satisfactory, but with crushed rock, slag or other large or heavy materials it is important to have a high-powered bucket, in some cases fitted with teeth. The John F. Byers Machine Company, of Ravenna, Ohio, manufacturers, guarantee one round trip of boom and bucket per minute.

New Model Hoist

A new model Little Tugger hoist has been brought out for the use of those who prefer manila to wire rope for light hoisting and hauling. This is designated as No. 11 by the Ingersoll-Rand Company, New York City manufacturers, and is essentially similar to the No. 1 model in its square piston, reversible driving engine, automatic lubrication, enclosed gearing, drum-release clutch and worm-operated band brake. The most noteworthy variations are in the diameter and length of the drum, the width of the flanges and, of course, the main frame and over-all dimensions.

The new model Little Tugger has a hoisting drum 7 in. in diameter by 17 in. long, with 5-in. flanges, thus accommodating 300 ft. of ⅞-in. manila rope. Conservatively estimated, the maximum capacity of this hoist is about 600 lbs. The hoist is 21 in. long, 31¼ in. wide, 23 in. high and weighs 358 lbs.



It is built for operation by either steam or compressed air. The standard clamps fit a 4½-in. diameter column or pipe, and by removing the clamp the hoist can readily be bolted direct to any convenient support, timber or flooring. Altho designed primarily for underground work, it can be used for general hoisting work, hauling and manipulation in tunnels, pits, quarries or industrial plants.

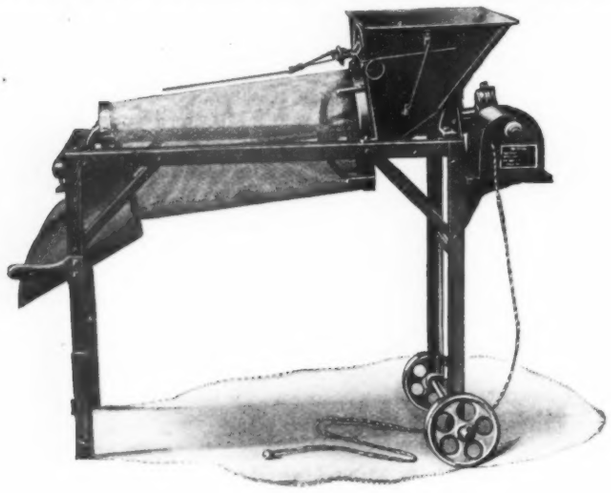
Grand Rotary Sand Riddle

Increased efficiency in sand sifting work is claimed for the Grand rotary riddle, which has several new and interesting features. The most significant of these are (1) the use of interchangeable screens, which enable sifting in various sizes according to the needs of various machines; (2) a special tapping device for keeping the screen clear and thus allowing the handling of wet and dry material with equal ease.

Construction is wholly of iron and steel. The frame is made of heavy angle-iron, securely braced, and is square so as to permit wheelbarrows being run under it. The hopper is of heavy-gage steel, reinforced with a round rod rolled in the top of it and rigidly held in place by heavy iron brackets. The hopper is low to shovel into, yet the drum is high enough above the ground to permit of screening into a wheelbarrow. An auger in the hopper makes the machine a force-feed, so as to handle very wet and sticky core sand.

The rear end of the machine is mounted on large iron wheels and the front end is equipped with two handles so that one man can easily wheel the riddle to any part of the work.

The front legs of the machine are adjustable and may be lowered to give any pitch desired for the best handling of the material. This is a great advantage in screening and mixing core sand that has just been mixed with oil, as all lumps are broken up before reaching end of drum.



The drum is mounted on tubing, which easily slides over the main shaft and engages the clutch to revolve same. This drum is 14 in. in diameter and 36 in. long, giving 10½ sq. ft. of screening surface at one revolution of drum. It revolves 37 r.p.m., giving a large screening capacity and it only requires two minutes to remove one drum and replace it with another of different mesh wire cloth, thus giving the machine a wide range of work. The wire cloth on these drums can also be changed by loosening the steel spring bands at each end of the drum.

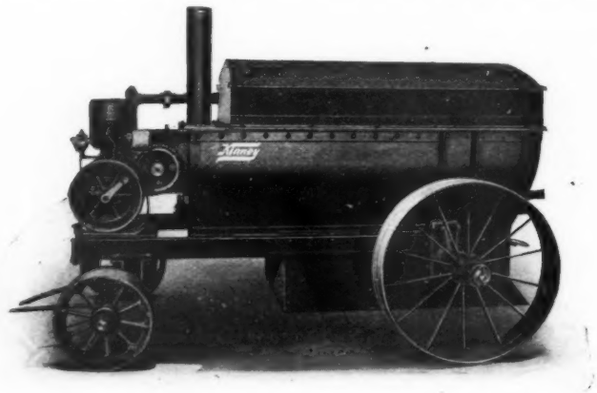
The patent automatic tapping device keeps the screen clean at all times, no matter whether materials are wet or dry. This tapper is quickly adjusted to strike a heavy, medium or light blow, or can be thrown out of operation entirely when screening dry material. Owing to the manner in which the materials are handled in the screen, it is claimed there is practically no wear to the wire cloth.

The machine can be operated either with a crank for hand power or with a pulley, which can be connected by belt power to a regular line shaft. The Hall-Holmes Manufacturing Company, of Jackson, Mich., are the makers.

Handy Heater and Sprayer for Bituminous Materials

Considerable difficulty is often experienced in handling heated bituminous materials on a small scale, largely because of the more or less inferior and improperly constructed appliances so often used for the purpose. The accompanying illustration is that of an improved heater and sprayer especially designed to overcome existing difficulties.

The machine is similar in construction to many forms of tar kettles now in use, being a steel tank of capacity ranging from 300 to 600 gallons; the tank being equipped with a



large-sized fire-box underneath, adapted for burning wood, coal or coke. The tank is jacketed by a heating chamber, which is extended on the front so as to receive and enclose a Kinney pump, which is driven by gasoline engine, as shown in the cut, or may be driven by hand power, as desired. The important advantage of the heating chamber is that the pump is kept heated at all times, thus preventing the hardening of material within the pump and so preventing its operation.

The pump is adapted to take the material from the tank thru proper screens or strainers, passing it thru the discharge pipes, equipped with proper valves extending to the rear end, where it is adapted for connection with the spraying hose and nozzles for the application of bituminous material thru the nozzles. The discharge pipe also is so made that the stream may be diverted into the tank, thus establishing a circulating system, which facilitates the heating and at the same time

prevents the material from hardening or coking to the bottom of the tank.

The machine is mounted upon steel wheels with broad tires and can be drawn by hand, steam roller or tractor. It may be furnished with attachments for hoisting barrels, also with a warming closet for warming barrels of heavy material for easy dumping into the heater.

It is made by the Kinney Manufacturing Company, Boston, Mass.

No Repair Bills Except for Bridge

The big Federal motor-driven street flusher operated by the city of Vicksburg, Miss., recently started out to deliver 850 gal. of good drinking water to the State troops, which are encamped a few miles out of town. Just as the truck crossed

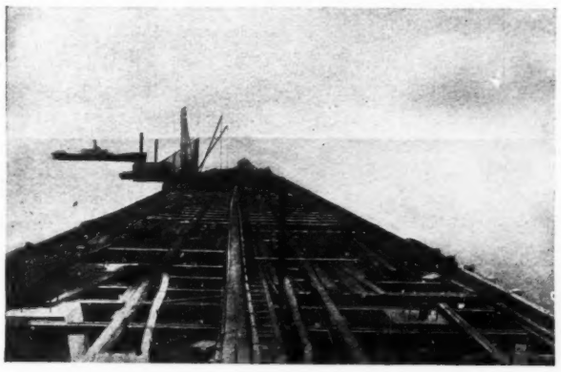
a bridge on the outskirts the heavy planking gave way and the truck went thru, resting on the worm axle, as illustrated herewith.

No injury was done to the truck except the loss of a little paint.

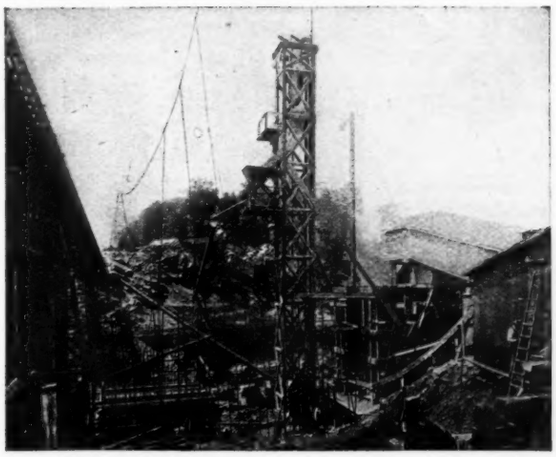
Pneumatic Concrete Mixing and Placing

Pneumatic mixing and placing of concrete has demonstrated its adaptability, efficiency and economy on big jobs of many different kinds. Several prominent engineers already concede that this method will supersede all others for certain types of construction, such as tunnel work, subways, etc. It is said that the pneumatic mixing and placing machine can effect a saving of approximately from $1.50 to $2.50 per cubic yard over the old method.

This efficiency, of course, depends largely on the proper



DISCHARGE PIPE FROM A RANSOME-CANNIFF PLACER CONVEYING CONCRETE FOR CONSTRUCTION OF A COAL PIER. PIPE LAID IN CENTER OF FALSE WORK.



RANSOME - CANNIFF PNEUMATIC MIXER AND PLACER WITH A SPOUTING SYSTEM IN BRIDGE CONSTRUCTION.

designing and co-ordinating of the entire construction equipment, particularly that part of the plant which can be made to utilize compressed air. The pneumatic mixer and placer requires a compressor of large capacity, and it is essential that the compressor be used for other power functions than concrete mixing. It is often advisable to install a sufficiently large compressor to run the entire auxiliary equipment in daylight hours and then place concrete in a few hours during the night. Then, by use of the excess compressed air available, the output can be greatly increased.

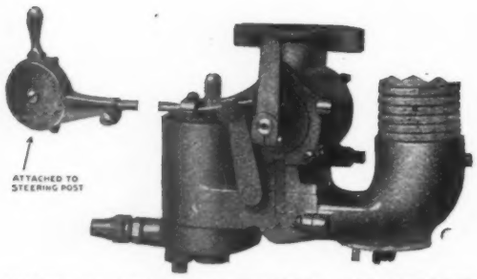
The accompanying photographs are illustrative of certain large jobs upon which pneumatic machines were recently used. The chief engineer for the Degnon Contracting Company, New York—now operating two pneumatic mixers and placers—reports that they have proven "highly satisfactory in performance." "Our first machine," he says, "has been in use on our 59th street subway contract in New York City and has placed all the concrete lining in some 800 ft. of double-track subway, most of which was rock tunnel, and the balance open cut construction. It has worked successfully on both classes of work. The machine is most valuable in placing concrete that would otherwise have to be hand-shoveled, particularly in the arch of the tunnel. We find there is a large saving in mixing and placing with it."

Similarly favorable comment is made by A. A. Brewer, engineer for the Flinn-O'Rourke Company, Inc., big New York City contractors, who now are using three pneumatic mixing and placing machines. Like testimony from the big engineering firm of T. A. Gillespie Company, High Falls, N. Y., and the Pennsylvania Water and Power Company, Baltimore, Md., seems to establish the enthusiastic assertions of the Ransome Concrete Machinery Company, Dunellen, N. J., for their machines and methods.

Carburetor for Fire Apparatus

Motor fire apparatus is regularly called upon to meet sudden and strenuous exigencies which the ordinary contractor's truck rarely meets. It must do all that is expected of the ordinary truck at a greater speed and with complete reliability. It has to snake at top speed thru dense traffic; to be unaffected alike by bad roads and weather conditions.

The fire-truck driver should realize how much of his truck dependability depends upon its carburetion. The accompanying illustration is of the "Master" carburetor, which is said to be specially adapted for fire apparatus service. Its two most salient features are the control and the device for distributing fuel, both designed to give perfect vaporization and so eliminate the possibility of frequent adjustments.



SHOWING ALL HOT VERTICAL AIR INTAKE.

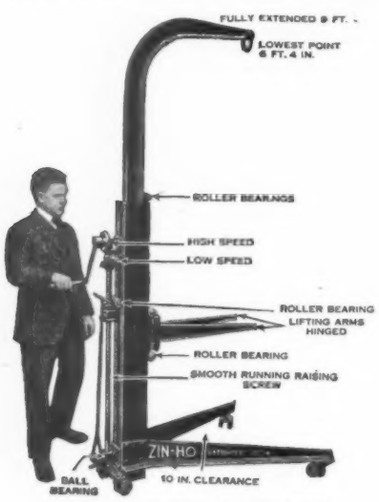
Fuel is fed into the combustion chamber thru a series of 14 to 21 tiny holes, their exact number depending upon the size of the carburetor. They are said to break up the fuel more thoroly than can be done by ordinary nozzles or jets. At the top of the fuel distributer there is a rotary throttle. When this is closed only one little hole is exposed, permitting the escape of only enough "gas" for idling or very low speed. The gas supply is augmented proportionately as the throttle is opened wider and more of the tiny holes are exposed. When left wide open the gas is let out in the form of a minutely broken-up spray, which makes for perfect combustion.

Control of the live mixture is vested in a small lever located near the driver on either the steering post or dashboard. Variable conditions of speed, grade or weather cannot influence the mix adversely and the operation of this lever is even more simple than that of the spark lever, inasmuch as there is no necessity of changing the control so frequently. The lever's central position affords a normal running mixture and a mere shove to one side or the other will give either a rare mixture for high speed or a rich one for quick starting in cold weather.

The Master carbureter originated in California, where the varying atmospheric conditions from foggy sea level to the rarified air of mountain tops demand the highest carbureter efficiency. It has already been installed on the machines of the fire department of Boston, Rochester, San Francisco, Oklahoma City, Grand Rapids, New York City, Detroit, Los Angeles, Spokane, Denver, Phoenix, Atlanta and many others, according to the Master Carbureter Corporation, of Detroit, Mich., its manufacturers.

Zin-Ho Portable Crane

Herewith is illustrated the Zin-Ho portable crane, which is especially adapted for use in general construction work and in utility plants, municipal stores or yards and in central fire stations operating motor-driven apparatus. Portability and easy one-man operative features make it convenient under all conditions. Its work can be regulated with exactitude by means of its raising screw. The entire outfit weighs only 350 lbs. and is capable of hoisting 4,000 lbs.



ZIN-HO PORTABLE CRANE.

The crane is equipped with a telescope mast with a davit type head. A smooth-running vertical head screw, driven by a crank handle thru gears giving either high or low speed, raises the mast to a height of 9 ft. 3 in. It can be lowered to 6 ft. 4 in. The thread of the lifting screw is so fine that the crane can be manipulated to a fraction of an inch. The value of this feature is readily apparent where machinery is to be handled.

Lower down on the vertical support there are two hinged arms for jacking or lifting. When it is desirable to use only the boom these arms can be swung out of the way. The base comprises two supporting beams, under the ends of which and also beneath the bottom of the mast are casters. The bases of the swinging arms and the boom are equipped with ball bearings.

The crane is made by the Zin-Ho Manufacturing Company, of Chicago, Ill.

Motor Truck Salesmanship

Mr. Lynn B. Dudley has been appointed advertising manager of the Federal Motor Truck Company to succeed Mr. Geo. W. Cushing, who recently resigned to take a position in the advertising department of the Hudson Motor Car Company. Mr. Dudley is well qualified to take up his new work, having had 12 years' experience in the editorial and advertising departments of newspapers, and for 3 years has been connected with Campbell-Ewald Company, advertising agents. He has specialized in automobile, gas-engine and motor truck accounts, and for some time past has had supervision of the agency account of the Federal Motor Truck Company. Owing to his close association with the Federal organization, Mr. Dudley was selected for the position.

Trade Publications

The Construction of Roads and Pavements, by T. R. Agg, professor of highway engineering, Iowa State College. Cloth, 432 pp. McGraw-Hill Book Co., 239 West Thirty-ninth street, New York City.

Copies of specifications for waterproofing mass concrete, cement, stucco, walks and floors with a thin coat, issued by The Aquabar Co., have been received from P. R. Baker, their Indianapolis representative, 2255 Talbot avenue. They are accompanied by a reproduction of blue prints showing the methods of making the applications.

The fourth volume of "Motor Trucks of America," for 1916, has been issued by The B. F. Goodrich Co., Akron, Ohio, and gives descriptions and photographs of 103 American motor trucks, all of which use Goodrich tires. It is a very valuable publication for anyone interested in motor trucks or becoming

interested in their use, which is the state of mind of very many who use means of transportation in their business, whether for collection and delivery of materials and products or in the numerous ways of the contractor.

Kansas City's Pumping Engine

Herewith is illustrated a latest design horizontal cross compound crank-and-flywheel pumping engine recently installed in the city of Kansas City, Kas., which Mr. L. H. Chapman, water and light commissioner, states has been giving perfect satisfaction in practically continuous operation under governor control ever since being placed in service.

The pump is of the duplex double-action type, with outside center-packed plungers and is fitted with rubber pump valves arranged in easily removable cages. The main pump chambers are said to be especially effective owing to their close proximity to the suction valves. The steam pistons and pump plungers are connected thru cross-heads and double distance rods.

The steam cylinders are fitted thruout with Corliss releasing valves, having separate eccentrics for the steam and exhaust valves on each cylinder, thereby allowing an economical adjustment and giving great flexibility with large variations in water and steam pressures.

The condenser is usually of the surface type, located in the main suction line to the pumps. This arrangement insures an abundance of cooling water at all times, with no expense for circulating pumps or loss due to wasting water for condensing purposes.

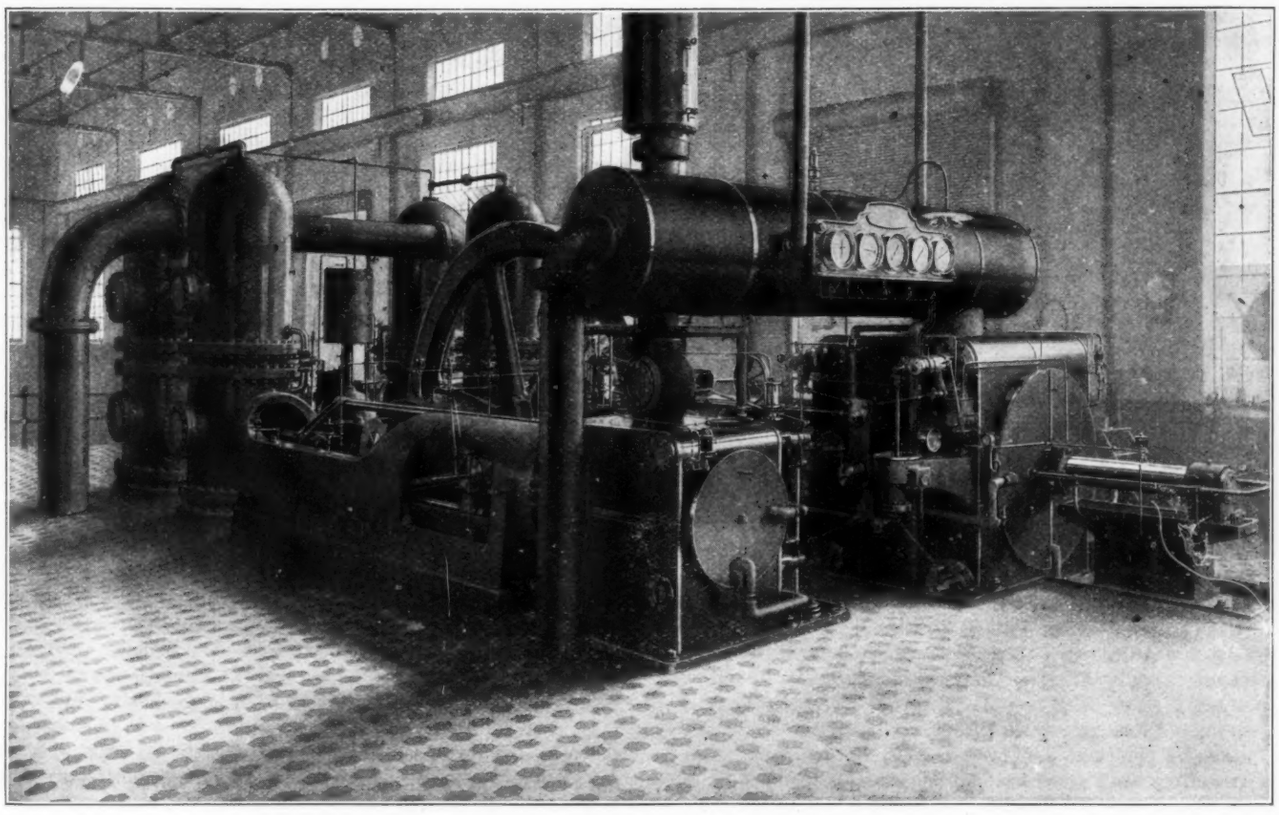
The receiver, located between the high and low-pressure cylinders, is of large size and forms an ample reservoir for the low-pressure cylinder to draw upon. This receiver can be located either above or below the cylinders, to suit local conditions. The exhaust pipe leads from the low-pressure cylinder to the steam inlet of the condenser, and from this point the exhaust steam makes two complete passes thru the condenser tubes to the suction pipe of the air pump. The condensed steam drains by gravity to the air pump, which is driven by a special eccentric on the main shaft of the engine. In this way the air pump is operated at the same steam economy as the main unit and, owing to the small power required and the ample cooling water available, a very high vacuum is obtained at practically no cost.

In addition to the air chambers formed in the two suction boxes an air chamber of liberal proportions is furnished and located at some convenient point on the suction line near the pumping engine.

Very liberal discharge air chambers are located immediately over the discharge valve decks and insure easy operation with a uniform flow of water and freedom from jars or knocks. All working parts are accessible for the convenient making of adjustments.

The pumping engine operates under the following conditions, which speak for themselves:

Capacity, 12,000,000 U. S. gallons per 24 hours.
Total head, 324 feet to 393 feet.
Steam pressure, 150 lbs. per sq. in.
Revolutions per minute, 42.85.
High pressure cylinder, 27½ in.
Low pressure cylinder, 52 in.
Plunger, 19 in.
Stroke, 42 in.
Flywheel, 16 ft. diam., 35,000 lbs.
Condenser, surface type of the Allis-Chalmers manufacture, located in main suction line.
Cooling surface, 1,500 sq. ft.
Air pump, attached type-double, 17 in. diameter by 14 in. stroke.
Attached feed pump, 3¾ in. by 14 in. stroke.
Valve area of each quarter of suction and discharge deck 661.5 sq. in.
Number of cages in each quarter, or for each deck, 7.
Percentage of valve area to plunger area, 240 per cent.



Duty guaranteed, 148,000,000 foot pounds of work per 1,000 pounds of dry steam.

Duty obtained on official test, 160,040,000 foot pounds of work per 1,000 pounds of dry steam.

The unit is a product of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

Steam Shovels and Trucks Work Together

Carlin Brothers, of San Francisco, Cal., recently secured the contract for the removal of 9,000 cu. yds. of material from the basement of a large apartment building on a hillside at the corner of Post and Leavenworth streets. Their first procedure was to install the most modern equipment they could find, which in their case comprised a fleet of eight motor trucks and a Bucyrus revolving steam shovel.

No unusual problems were encountered on the job, the feature being, of course, the extremely hard material to be handled. It was thought at first that blasting would be necessary before it could be loaded economically by the small shovel, but a trial soon convinced them that the machine could handle it without any trouble. On this job, the material consisting of hard shale, earth and boulders, the shovel averaged 265 cu. yds. per day. Its makers, The Bucyrus Company, South Milwaukee, Wis., say that this is no unusual record for it.

Dynamite in Road Building

In going through a cut in light soil dynamite helps in loosening up the dirt if charges of a half cartridge of 20 per cent. Red Cross are fired in holes to the required depth, five or six feet apart each way. Then the scrapers can handle it with ease, doing away with a great amount of hand-picking and shoveling. In a hard clay soil charges of one to two cartridges of 20 per cent. dynamite may be used in holes four to six feet deep, and spaced about six feet apart, and will be found satisfactory for loosening the soil for the scrapers.

Outcrops of rocks are frequently met with in road construction and, of course, require to be drilled either by hand or machine drill for the economical use of explosives. Where it is not possible to drill these outcrops, they may sometimes be mudcapped, but this takes several times as much dynamite to do the work under most favorable conditions as compared with that required in a drill hole, and, frequently, is absolutely impractical. Boulders may sometimes be blasted by firing charges in holes driven beneath them with a bar, or they may be drilled and fired, or, if very hard and brittle, it is most economical to mudcap them.

Stumps may be taken out economically and quickly by firing charges of dynamite under them, placed far enough below the surface of the ground so that the crater produced will include the greatest proportion of the roots.

Ditching is frequently necessary and may be done in two ways, depending on the character of the soil. In a dry, sandy soil single cartridges, 1¼ by 8 inches, of dynamite are placed in holes two to three feet apart and two to two and one-half feet deep, with an electric blasting cap in each hole and the entire line connected up in a series and fired with a blasting machine. In very wet, heavy soil or swampy muck, the ditch may be made by firing charges of one cartridge of 50 per cent. straight dynamite in each hole spaced 18 inches apart and two to two and one-half feet deep. In this case it is not necessary to use an electric blasting cap for each hole. One extra cartridge placed in a hole near the center of the line of holes and fired by either an electric blasting cap or a blasting cap will detonate the entire line by influence. Ditches have been dug over a thousand feet long by this method. A hand-dug ditch usually costs just about twice as much as a dynamited ditch.

Sink-holes, mud holes, bog and miry spots in low-lying portions of country roads are often effectually and permanently drained by firing charges of dynamite in holes driven into the impervious stratum of soil, usually clay or hard-pan, which forms the basin and prevents the water from running down into the earth. These charges should be fired fifteen or twenty feet apart each way, the depth depending upon the nature of the soil. Wet spots in roads have been permanently cured at very little expense by this method.

Dynamite is one of the handiest and most reliable helps the road-builder can have in his equipment. It can be used for felling trees, making post holes for fences or planting trees, and for digging and loosening up the soil for telegraph and telephone pole holes.

Road builders as yet have not exhausted the possibilities of its usefulness, but those who have carried it in stock and used it intelligently would no more dispense with it in any operation than they would with their equipment of picks and shovels.

A Durable Pump

A remarkable performance of the Atlantic diaphragm pumping engine of the Harold L. Bond Company of Boston is reported from Alaska, where the city of Skagway used one for three years in sand and gravel at all times and it is still on the job all the time and has never failed to give entire satisfaction.

Trade Notes

The Cleveland Brick and Clay Company, of Cleveland, O., has been added to the list of licensees of the Dunn Wire-Cut Lug Brick Company, of Conneaut, O., and henceforth will make wire-cut lug paving brick. The company is one of the most prominent paving brick manufacturing concerns in northern Ohio, and it has a daily productive capacity of 60,000 blocks. J. L. Higley is president of the company, and A. L. Hendershot is secretary.

The Buffalo Steam Roller Company, Buffalo, N. Y., and the Kelly-Springfield Road Roller Company, Springfield, O., have been combined into the Buffalo-Springfield Roller Company, with main offices and factory at Springfield, O. The entire sales organization of the Buffalo company, as well as the full line of Buffalo-Pitts rollers, will be taken over by the new company. With the tandem and macadam types, the steam and gasoline rollers of both companies, the list will be complete in styles and in sizes from 2½ to 20 tons.

The Jamestown Shale Paving Brick Company, of Jamestown, N. Y., has become a licensee of the Dunn Wire-Cut Lug Brick Company, of Conneaut, O., and will make wire-cut lug paving brick. This company has been making paving brick for more than thirty years and has rebuilt its plants so they are modern, up-to-date and fireproof. It has a daily capacity of 65,000 blocks. It operates five rectangular kilns, with a daily capacity of 25,000, and a continuous kiln, with daily capacity of 40,000. The company has seventy-five acres of workable shale bed from 75 to 100 feet, within the city limits of Jamestown. The officers of the company are: A. N. Broadhead, pres.; Thomas Mahoney, vice pres.; John Mahoney, treas.; J. B. Fisher, sec.; R. F. Fisher, mgr.; A. B. Green, supt.

The Purington Paving Brick Company, of Galesburg, Ill., has become a licensee of the Dunn Wire-Cut Lug Brick Company, of Conneaut, O., and will engage extensively in the manufacture of wire-cut lug brick. The Purington company is one of the biggest paving brick concerns in the United States, with a daily output capacity of about 350,000 brick. The Purington organization consists of F. G. Matteson, president and treasurer; George C. Prussing, vice president; C. D. B. Howell, vice president; W. H. Terwilliger, secretary; W. G. D. Orr, general manager.

The Citizens' Company, B. N. Brennan, president, Baltimore, Md., finances corporations, engages in underwriting, and handles for its own account complete issues of securities.

Fred E. Boylan has resigned his position as manager of the Detroit branch of the Swinehart Tire and Rubber Company, and has been appointed factory representative of the Sewell Cushion Wheel Company. With a view of working the territory more intensively, Mr. Boylan will divide his time with their branches in Cleveland, Buffalo, Rochester, Boston, New York, Philadelphia, Baltimore, Pittsburg, Cincinnati, St. Louis, Chicago and Minneapolis.

The patent on the Ferguson reinforced concrete dock or pier, now constructed by the Cleveland Dock Engineering Company, Cleveland, O., has been sustained in a decision of the United States Circuit Court of Appeals, in the case of James D. Carey, president of the company, against the Detroit Steel and Iron Company.

Rural contractors specializing in concrete work, especially those building silos and other far mstructures, also contractors or others who would like to specialize on such work, will be interested in knowing of a co-operative plan now being carried out by the Extension Division of the Portland Cement Association. Any one interested in concrete contracting work or in taking up such work, is urged to address a letter to the director, Extension Division, Portland Cement Association, 111 West Washington street, Chicago, for some information that will prove valuable, and that can be obtained without cost or other obligation.

The Chain Belt Company of Milwaukee, Wis., has appointed Mr. C. F. Messinger manager of their Concrete Mixer Department. Mr. Messinger has for years managed the Advertising Department and is thoroughly acquainted with the mixer business. He will take charge at once and will augment the service feature which has always accompanied chain belt mixers. Mr. Messinger is a graduate of the Sheffield Scientific School of Yale University and is well known by mixer men thruout the country.

Two additional licensees have been added to the family of the Dunn Wire-Cut Lug Brick Company, of Conneaut, Ohio. These are the Streator Clay Manufacturing Company, Streator, Ill., which has recently completed a new plant with a daily capacity of 60,000 paving block; R. H. Green, president; James A. Green, vice president, and John Connelly, secretary; also the Martinsville Brick Company, of Martinsville, Ind., with a daily productive capacity of 30,000; E. J. Poston, president; B. C. Poston, vice president; O. E. Sweet, secretary.

Trade Publications

A handsomely illustrated booklet of the National Concrete Company of Indianapolis, Ind., shows the construction of the West Washington street bridge in that city by this company.

The Ideal Mortar for Brick Masonry, Mortar No. 5, produces maximum strength with minimum expense, as demonstrated in Bulletin J of the Hydrated Lime Bureau of the National Lime Manufacturers' Association, Arrott Bldg., Pittsburg, Pa.

Economic Brick Mortar and Permanently Dry Basements are the titles of 2 circulars of the Hydrated Lime Bureau, Arrott Bldg., Pittsburg, Pa.

Concrete Houses and Why to Build Them, Concreting in Cold Weather and That Alley of Yours are 3 interesting bulletins of the Portland Concrete Association, 111 West Washington street, Chicago, Ill.

Novalux street lighting units for Mazda series lamps and street lighting brackets and center span fixtures for Mazda lamps are shown in full detail in two booklets of the General Electric Co., Schenectady, N. Y.

Dynamite in fish culture is the subject of a paper by E. V. Gardner, C. E., Goshen, N. Y., which is republished by E. I. du Pont de Nemours & Co., Wilmington, Del.

Standard pumping units for water supply are shown in detail in a catalog of The Standard Pump and Engine Co., Akron, Ohio, using handpower, gas or gasoline engines or electric drive, suction or deep well pumps, compressed air tanks for delivery of water when pump is not running; also combined pump and electric light plants. Plans for foundations for engines and pumps are also given. Capacities run up to 4,000 gallons an hour.

Wallace & Freman Co., New York, issue a booklet comparing the cost of sterilization of water and sewage by the use of hypochlorites and of liquid chlorine.

The Domestic Engine and Pump Company, Shippensburg, Pa., is distributing a new 28-page 6x9 illustrated bulletin, describing their line of gas-engine-driven contractors' machinery, which includes diaphragm, centrifugal, combination and force pumps, geared and chain-driven hoists and special hoisting outfits for applying power to hand derricks. A number of new electric-motor-driven pumping outfits are also shown. A copy of this bulletin may be obtained by application to the Domestic Engine and Pump Company.

A reprint from the *Oregon Voter* of June 12, 1915, gives the extensive quotations from the report of the paving committee of the Portland Chamber of Commerce on the public contracts then to be let under the bond issue passed for good roads. It is handsomely illustrated and goes into some detail regarding the life of concrete, Hassam, Warrenite and Topeka specification pavements, and the patents involved. The conclusions are fully stated, recommending Warrenite for all the roads except under certain conditions of grade, where Belgian blocks are recommended, using Oregon stone. Experiments with wood block, also an Oregon product, are recommended.

"Better Roads" and "Highway Maintenance" are the subjects of two folders on Howe's road combinations and methods of road treatment, issued by the S. G. H. Rubber-Stone Co., Detroit, Mich.

Contracting News

AUTOMOBILE FIRE APPARATUS AND MOTOR EQUIPMENT.

BIDS REQUESTED.

Atlantic Highlands, N. J.—Until Jan. 9, on motor-driven apparatus.

Harrison, N. J.—Until Dec. 5, for furnishing 2,000 ft. of fire hose.

LaCrosse, Wis.—Until Dec. 5, for furnishing city with 1,000 ft. fire hose and two city service trucks. Add. Bd. of Pub. Wks.

Lakefield, Minn.—Until Dec. 5, for 60-gal. chemical engine. Add. L. W. Rue, Vil. Clk.

CONTEMPLATED WORK.

Alameda, Cal.—Fire Comm. has purchased plans and specifications for two pieces of motor equipment.

Alliance, Ohio—Ord. No. 2241 passed, providing to issue bonds of $1,000 for purchase of motor equipment for fire chief. Chas. O. Silver, City Audr.

Baldwinsville, N. Y.—City contemplates purchasing piece of motor apparatus.

Baltimore, Md.—The purchase of four steamers and seven trucks, three motor combination cars and other equipment, has been taken under consideration for 1917.

Bristol, Pa.—Cornwells Fire Dept., Cornwells, reported as considering purchase of fire apparatus. Funds now being appropriated.

Chattanooga, Tenn.—The purchase of combination chemical and hose car at an early date, has been recommended. Est. cost $4,500. T. C. Betterton, Fire and Police Commr.

Coopertown, N. D.—City of Bismarck is to motorize their fire department and are about to purchase a fire truck. A street flusher probably will be purchased, too.

East Milltown, Pa.—Considering the purchase of motor fire apparatus in the near future.

Evanston, Ill.—Council Comm., Mr. H. E. Chandler, chairman, has been requested to make appropriation for purchase of five more pieces of motor-driven fire apparatus.

Garfield, N. J.—The purchase of a piece of motor apparatus for Fire Co. No. 1 is contemplated. Bids will be advertised shortly.

Great Falls, Mont.—City Engr. prepared specifications for purchase of one motor-driven comb. pumping, chemical and hose truck. Six cylinder, 60-h.p. eng., centrifugal pump, chemical tank and three ladders.

Harrisburg, Pa.—Ordinance introduced to city council requesting city to loan $60,000 to appropriate for motorization of fire dept. Chas. A. Miller, Clk. of City Council.

Hartford, Conn.—The Fire Commrs. of Windsor District have been authorized to advertise for bids for purchase of 600 feet of fire hose.

Heweitt, L. I.—Fire Commrs. have decided to purchase a new motor apparatus, which is to be combination chemical engine and hose truck with junior pump.

Hinsdale, Mont.—Bd. of Commrs., Valley Co., have approved of purchase of fire apparatus. Est. cost, $1,200.

Huntington, Ind.—Bids will be requested for purchase of motor apparatus.

Lockport, N. Y.—Voters have approved the issuance of bond issue of $12,000 for purchase of several pieces of motor apparatus.

Manchester, N. H.—Bond issue of $25,000 for purchase of two motor pumping engines and two motor hose cars, has been approved.

McPherson, Kans.—Petitions being circulated requesting city council to purchase fire apparatus.

Newburgh, N. Y.—Vil. of Deacon are to install fire alarm system at est. cost of $3,000 from $186,655, which is to be appropriated for improvements.

New Castle, Ind.—City Council voted and approved of the advertising for bids for furnishing automobile for fire chief.

Piedmont, Cal.—Bond issue of $25,000 approved for fire department improvements.

Quincy, Mass.—An ordinance presented to Fire Committee requesting an appropriation of $6,000 for three motor hose cars.

Sacramento, Cal.—An appropriation of $16,000 has been decided for purchase of motor-driven apparatus.

BRIDGES.

BIDS REQUESTED.

Americus, Ga.—Until Dec. 11, for construction of bridge over Flint River at Murray's Ferry. Est. length, 1,300 feet long, of concrete or steel. Address City Clerk.

Ann Arbor, Mich.—About January 1, for construction of rein. concrete bridge 620 feet long across Huron River. Est. cost., $45,000. Add. John C. Cox, State Highway Commr.

Barbourville, Ky.—Until Dec. 9, for construction of two bridges, one over Little Richmond Creek, one over Stinking Creek, and 12 smaller bridges. Add. Read P. Black, Clk., Knox Co., Crt.

Chillicothe, Mo.—Until Dec. 9 (12 noon), for construction of seven reinforced concrete bridges; also grading of Haynes Hill Add. Joe Broaddus, Bridge Commr.

Crown Point, Ind.—Until Dec. 8 (10 a. m.), for construction of concrete culvert. Edw. Simon, Audr. Add. bids to Commrs. of Lake Co.

Gastonia, N. C.—Until Dec. 6, for construction of steel bridge, two spans, over Long Creek, 2 miles from Gastonia. Add. O. B. Carpenter, Clk. Co. Commrs.

Litchfield, Minn.—Until Dec. 13 (2 p. m.), for construction of pile trestle bridge, 112 feet long over Lake Koronis, Sec. 2, Union Grove. Add. A. O. Palmquist, Meeker, Co. Audr.

Lisbon, Ohio.—Until Dec. 11 (1 p. m.), for construction of Bridge No. 846, known as Canton Bridge, in Center Tp. Certified check $250. Add. H. R. Dickey, Clk.

Molino, Fla.—Until Dec. 12, for construction of bridge and approaches over Escanaba River. Add. W. C. Barrineau, Chrmn. Escanaba Co. Commrs., at Pensacola. Plans with Geo. Rommel, Engr., Pensacola.

New Castle, Pa.—Until Jan. 1, for construction of bridge over Neshannock Creek on Gardner Ave. Est. cost $35,000. Bids recd. by Co. Commrs. of Lawrence Co. T. A. Gilkey, Engr.

Newton, Iowa—Until January 1, for construction of concrete culverts and bridges. Est. expenditure $25,000. Add. Mr. C. O. Edge, Co. Audr.

Potter, Wis.—Until Dec. 15, for construction of concrete bridge, 5 piers, two abutments on 50-ft. piles, six 40-ft. spans, 20-ft. roadway and concrete floors. Est. cost, $20,000. Add. bids to Wm. Hoenig, Brillion, Wis. All above is a report. Not official.

Springfield, Ill.—Until Dec. 5 (2 p. m.), bids will be recd. at Farmers Natl. Bk. in in Genesco, for construction of two rein. concrete bridges in Edford Tp., Henry Co., known as Gotthardt and Newman bridges. Spans 18 and 20 ft., roadways 18 ft. Est. cost $2030 and $1490 respectively. Jas H. Reed, Co. Supt. of Highways, Cambridge, Ill.

Seale, Ala.—Until Dec. 7, for construction of bridge over Brush Creek on Tuskegee and Columbus Rd., including concrete piers. Add. bids to Russell Co. Plans with W. S. Keller, St. Hgwy. Engr., Montgomery.

Vienna, Ga.—Until Dec. 11, for construction of bridge over Flint River at Murrays Ferry. Add. Co. Clk.

CONTEMPLATED WORK.

Abingdon, Va.—Ch. Engr., Holston River Lbr. Co., preparing plans for construction of 200-ft. steel bridge.

Aurora, Ill.—To construct concrete bridge bridge with roadway 24 ft. wide and 50 ft. long over Ferson's Creek on west road north of St. Charles.

Canadian City, Okla.—Plans being prepared by city for construction of bridge over So. Canadian River on Jefferson Highway. Est. cost, $12,000.

Chicago, Ill.—Considering construction of bridge over Chicago River at 12th St., consisting of 2,500 tons steel and 2,100 sq. yds. creosote blocks. Est. expenditure, $600,000. Add. Dept. Pub. Wks. and San. Dist. of Chicago. Thos. G. Philfeldt, Cty. Bridge Engr.

Clearwater, Fla.—Pinellas Co. Commrs. to vote on $70,000 bond issue for construction of bridge over Boca Ceiga Bay to Island where Pass-a-Grille is located.

Columbia, Tenn.—Plans prepared for construction of bridges and culverts in Maury Co. Add. Co. Clk. Columbia. Est. cost, $10,818.

Covington, Ky.—Bond issue of $500,000 voted for improvements, including traffic bridge over Licking River, $40,000; other steel constructions, $95,000. Add. The Mayor.

Elizabeth, N. J.—Bd. Freeholders contemplated constructing 135 ft. span with 40 ft. roadway, known as Strauss bascule life bridge; also, wood block pavement at South Front St. J. L. Bauer, Co. Engr.

Flint, Mich.—Council planning to construct bridge across Flint River near Saginaw St. C. E. Shoecraft, Cty. Engr.

Gainesville, Tex.—Chamber of Commerce reports city is having plans prepared for constructing of bridge. Est. cost bet. $50,000 and $60,000.

Highlands, N. J.—Monmouth Co. preparing plans for construction of bridge over Shewsbury River. Est. cost $90,000. Add. Co. Clk.

Kansas City, Mo.—Plans prepared and approved by Bd. of Pub. Wks. for construction of bridge over Bush Creek on Elmwood Ave. Est. cost $11,000. Curtis Hill, Cty. Engr.

Kansas City, Mo.—Planning to construct bridge with proposed Chestnut Ave. through N. Terrace Pk. Est. cost $40,000. Add. Pk. Bd.

Mankato, Minn.—J. H. A. Brahtz, Supr. Engr., looking over the site on which concrete bridge known as Grand Ave. bridge, is to be constructed. Est. cost $185,000.

Marquette, Mich.—An appropriation of $9,000 has been made for construction of bridge in county during 1917. Add. Bd. of Supvrs.

Monroe, La.—L. N. Larche, Chrmn. Brdg. Comm., reports city is planning for construction of bridge across Ouachita River. Est. cost $300,000.

Montgomery, Ala.—County voted $50,000 bonds for construction of bridge across Tallapoosa River at Judkins Ferry, with concrete; also $50,000 for one across Tallapoosa River connecting Elmore and Montgomery Counties. R. H. Jones, Pres. Bd. of Revenue.

New Haven, Conn.—Edw. Gagel, Chf. Engr., New York, New Haven, & Hartford R. R., will furnish information with regard to construction of bridges calling for expenditure of $1,000,000.

Philadelphia, Pa.—Plans have been revised for new county bridge across Salem River. Est. cost $65,000.

Pond Creek, Okla.—Estimate submitted for construction of bridge over Salt Creek, for Chicago, R. I. & Pac. Ry., of $150,000. C. A. Morse, Chf. Engr., Chicago, Ill.

Rio Vista, Cal.—Plans being prepared for construction of Solano-Sacramento bridge. Est. length 2,400 ft., cost $170,000. Add. F. A. Steger, Vallejo, for further information.

Rison, Ark.—The expenditure of $10,000 for construction of bridge over Saline River is contemplated by Cleveland Co. Commrs. Contract will be awarded early next year (1917).

Rock Rapids, Iowa.—County Clk. will adv. for bids shortly for construction of sixteen bridges. Est. cost $80,000.

Santa Ana, Cal.—Contemplating issuing bond for $20,000 to construct Hanna Street bridge which was destroyed year ago.

Utica, N. Y.—New York Central R. R. planning construction of rein. concr, bridge over their tracks. Est. cost $30,000. C. W. Kittredge, Ch. Engr., Grand Central Term., N. Y.

Waco, Tex.—Bond issue of $25,000 approved for construction of bridges and culverts. Add. Mayor.

Woodbine, Ga.—Wm. M. Torrance, Civil Engr., Savannah, instructed to prepare plans for construction of bridge across Satilla River in Camden Co. Est. cost $20,000.

York, S. C.—York Co. contemplates constructing bridge over Catawba River in Fort Mill Tp.

LIGHTING.

Huntington, Ind.—Until Dec. 6 (10 a. m.), for construction of system of ornamental lighting for Huntington St. Bridge, Wabash, Ind. Add. Bd. of Commrs., Wabash Co. Frank P. Kircher, Audr.

Fergus Falls, Minn.—Contract awarded to Sterling Electric Co., St. Paul, for in-

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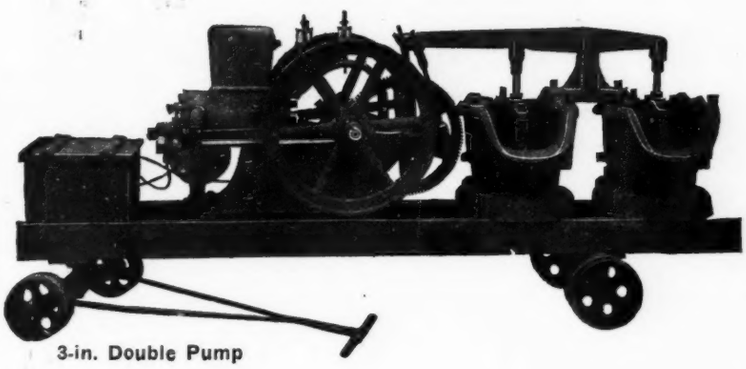

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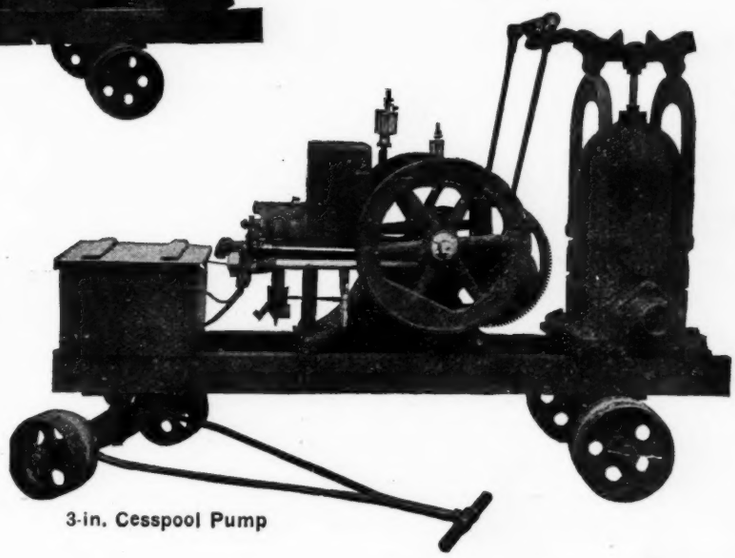

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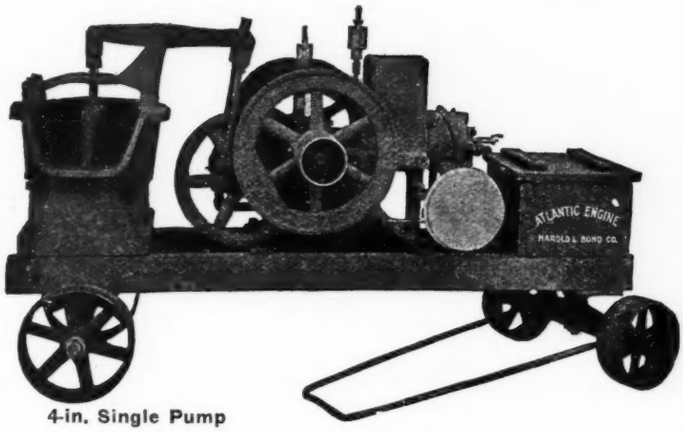

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Contracting News

AUTOMOBILES, FIRE APPARATUS AND MOTOR APPARATUS.

CONTRACTS AWARDED.

Cicero, Ill.—July 3, A. D., until 8 p. m., for 3,000 ft. of fire hose. Add. Charles Stoffel, town clerk, Cicero, Ill.

Berlin, Wis.—To Seagrave Co., Columbus, Ohio, contract for combination chemical and hose car.

Chicago, Ill.—To The White Co., Cleveland, Ohio, contract for three 4-wheel tractors for fire dept.

Kansas City, Mo.—To George C. Hale, of Kansas City, contract for furnishing 20 pieces of motor apparatus.

Peoria, Ill.—To Nallon Bros., contract for furnishing 500 feet of chemical hose, and 2,200 ft. of 2½-in. fire hose.

Franklin, Pa.—To E. R. Thomas & Co., Buffalo, N. Y., one cylinder, 90 h.p. combination truck with 500-gal. pump.

Saratoga Springs, N. Y.—To The American La France Co., Elmira, N. Y., contract for one motor-driven city service truck, at $6,100.

Quebec, Que.—To P. T. Legare, Ltd., contract for five auto sprinkling trucks, three auto sweepers and three light automobiles, amounting to $27,098.75.

CONTEMPLATED PURCHASES.

Albany, N. Y.—An appropriation of $30,000 is recommended for the purchase of motor apparatus.

Beatrice, Neb.—A fire company is being organized in Glenover and equipment will be purchased.

Beaver Falls, Pa.—Motor apparatus is being investigated with a view to purchase.

Cape Girardeau, Mo.—The voters have approved a fire department bond issue of $15,000.

Columbus, Kans.—Purchase of motor-driven booster pump to be installed on fire truck being considered. Information in regard to pump and method of operation desired by C. M. Cooper, city engr.

Herkimer, N. Y.—An election will be held to decide the question of issuing $6,000 in bonds for the purchase of fire apparatus.

Lake Wales, Fla.—Plans are being discussed for reorganizing the fire department and purchasing equipment.

Mattoon, Ill.—Ways and means are being discussed for purchase of motor apparatus.

Medford, N. J.—Funds are being raised for the purchase of motor apparatus.

New Castle, Pa.—Motor triple combination car to be purchased.

Newmanstown, Pa.—Plans have been prepared for a new station. Cost $10,000. C. L. Young, architect.

Northfield, Minn.—Funds are being raised for purchase of motor apparatus.

Olean, N. Y.—Fire committee has authorized purchase of a piece of apparatus, to cost $5.500.

Penns Grove, N. J.—A triple combination motor apparatus with a pumping capacity of about 500 gallons, will be purchased.

Salem, N. J.—Liberty Fire Co. is making an effort to raise $6,000 for the purchase of a piece of motor apparatus.

Southbridge, Mass.—Chief Joseph E. Duchesneau urges the early purchase of motor apparatus.

Tulsa, Okla.—Chief R. C. Alder recommends bond issue of $35,000 for fire department's betterments.

Windsor, Vt.—Vermont State Prison will be in market for motor truck. R. W. Walker, Supt. of Vermont State Prison.

BRIDGES.

BIDS REQUESTED.

Ainsworth, Neb.—Until July 3, for constructing a steel bridge 125 ft. long across Niobrara river at site of old McLain bridge.

Columbus, Mont.—July 3, until 5 p. m., for three steel highway bridges, one 32-ft. span, one 36-ft. span and one 3-span bridge 160 ft. in length. Lloyd B. Barley, county clerk.

Georgetown, Del.—July 11, until 11 a. m., for the construction of a drawbridge, a concrete pier on pile foundations, 30-ft. trestle approach. The bridge is over the U. S. canal at Rehoboth, Del. Deposit of $2. Morgan T. Gum, county road engineer.

Rehoboth, Del.—Until July 6, for constructing superstructure of bridge across U. S. Canal; cost $12,000.

Rensselaer, Ind.—July 3, until 2 p. m., for the construction of a grade, bridge, in Jordan twp. J. P. Hammond, auditor.

Santa Barbara, Cal.—July 3, until 10 a. m., for constructng a reinforced concrete bridge across Gaviota crek at Sta. No. 148 of the state highway, in Fourth Road Dist. C. C. 10 per cent. C. A. Hunt, county clerk.

Springfield, Ill.—July 5, until 11 a. m., for the construction of three reinforced concrete bridges to be built in Richland county. Spans, each 24 ft., roadway 18, 16 and 16 ft; height over all 10½, 11 and 10½ ft. Estimated total concrete, 63.6, 61.7 and 62.2 cu. yds.; reinforcing steel 7,500, 7,000 and 7,030 lbs. Engr. estimate for three bridges $3,380.00. Add. State Highway Dept., Springfield, Ill.

Springfield, Ill.—July 5, until 11 a. m., for the construction of one steel bridge on reinforced concrete abutments, to be built in Fulton county. Kessner Bridge: Span 100 ft., roadway 18 ft., height over all 20 ft. Estimated total concrete in abutments 173.8 cu. yds., reinforcing steel 7,500 lbs. Engr. estimate excluding piles, $6,910.00. Add. State Highway Dept., Springfield, Ill.

Spokane, Wash.—July 6, until 11 a. m., for reconstruction of three steel bridges; estimated cost $27,000. Reinforced concrete bridge over Spokane river; estimated cost $100,000. Concrete bridge and viaduct over Spokane river and Great Northern Railway tracks; estimated cost $135,000. Morton Macartney, city engineer.

Winchester, Ind.—July 1, until 12 a. m., for the construction and repair of eleven bridges. Chas. E. Tillson, tuditor.

CONTRACTS AWARDED.

Albany, N. Y.—To Holler & Shepard, Fort Edward, N. Y., contract for constructing Northumberland bridge, at $76,486.

Astoria, Ore.—To Washington Paving Co., L. C. Smith Bldg., Seattle, contract for constructing a reinforced concrete viaduct. Cost $147,727.

Ballinger, Tex.—To Austin Bros., Dallas, contract for constructing a bridge across the Colorado river at foot of Hutchins Ave., at $25,000.

Bridgeport, Conn.—To Edward DeVoe Tompkins, Inc., 17 E. 38th St., New York, N. Y., contract for constructing Grand St. and East Washington Ave. bridges, at $187,000.

Corydon, Ia.—To Akin & Flutter, Corning, contract for constructing bridges and culverts, at $7,219.

Des Moines, Ia.—To Koss Construction Co., Des Moines, contract for the construction of a reinforced concrete bridge, 160 ft. wide and 100 ft. long, reinforced concrete faced with Bedford stone, at $68,019.

Gary, Ind.—To Newkirk & Powers, contract for opening, grading and paving, constructing bridge and subways on Buchanan St., at $257,000.

Harrisburg, Tex.—To E. B. Van De Greyn, of Houston, contract for constructing lift bridge over Brays Bayou at Harrisburg, at $35,797.

Heuvelton, N. Y.—To Mecca Construction Co., Inc., Ogdensburg, contract for constructing a bridge across the Oswegatchie river, at $32,561.

Iron River, Wis.—To T. F. Mackmiller, contract for constructing bridge and dam School St., at $115,410.

Jefferson, Iowa.—To Marsh Engr. Co., Des Moines, contract for one deck girder, four concrete slabs, one box culvert and two I-beam bridges, at $17,954.

Kearney, Neb.—To Omaha Structural Steel Co., Omaha, contract for constructing a reinforced concrete bridge over Platte river between Kearney and Buffalo counties, at $44,350.

Mankato, Minn.—To J. H. A. Brantz, contract for constructing reinforced concrete arch bridge across Minnesota river, $100,000.

Lowell, Mass.—To National Engineering Corporation, Inc., contract for reinforced concrete bridge across Merrimack river at School St., at $115,410.

Minneapolis, Minn.—To Kalmann, Matheson & Wood, contract for constructing bridge at Third Ave., at $100,000.

Newton, Mass.—To T. Stuart & Co., Newton, contract for reinforced concrete bridge over Charles river, at $52,131.

Philadelphia, Pa.—To W. P. Mahoney, Harrison Bldg., contract for constructing bridge over Island Ave., at $128,000.

Providence, R. I.—To McKinnon Construction Co., contract for constructing Whipple bridge. Cost $30,698.

Rushville, Ind.—To Burk Construction Co., New Castle, contract for constructing a bridge across the Blue river between Rush and Hancock Co., at $11,000.

Sioux City, Ia.—To Ward & Weighton, contract for constructing 27 reinforced concrete bridges and one truss bridge, at $23,380.

Warren, Pa.—To Chas. Falk & Co., Cleveland, Ohio, contract for constructing a concrete bridge over Allegheny river, at $116,900.

CONTEMPLATED WORK.

Richmond, Va.—Plans are being made for the construction of a reinforced steel and concrete structure from North Twelfth St. to Littlepage St., connecting Fairmont with the city proper. John Hirschberger, chrmn. of administrative bd.

Harrisburg, Pa.—Plans for constructing bridge across track of Pennsylvania Railroad at Walnut St., to cost about $300,000, are being prepared by Greiner & Whitman. M. E. Cowden, city engr.

St. Paul, Minn.—Plans for a 270-ft., reinforced concrete, arch bridge, to be constructed for the city of Rice Lake, Wis., on Main St., across the Red Cedar river, letting about July 1. J. H. A. Brahtz, consulting engineer.

BUILDINGS.

BIDS REQUESTED.

Sturgeon Bay, Wis.—Until July 10, for erecting a bank building. Foeller & Schober, archts., Green Bay, Wis.

New Berlin, Ill.—July 5, until 8 p. m., for construction of township high school. J. N. Coleman, archt., 7100 So. Chicago Ave., Chicago.

Canton, Ohio.—To Indiana Engineering & Construction Co., of Ft. Wayne, Ind., contract for constructing remaining units of Daniel Worley Grade school, being erected on Twenty-third St., at $76,275. Total cost of building $124,000.

Cleveland, Ohio.—To C. E. Crumm, Wade Bldg., contract for a hospital to be erected on Prospect Ave. and East Thirtieth St., for Co-operate Hospital Assoc., cost $425,000. A. C. Edwards, 6k 615 Union Bldg., archt.

Little Falls, Minn.—To A. W. Lane, 19 South LaSalle St., Chicago, Illl, contract for erecting U. S. Post Office, using limestone, at $53,275.

Montreal, Que.—To L. Beaudry, contract for the erection of the Robin St. school. Cost, $136,000.

Newport, N. J.—To M. Yeager & Son, Danville, Ill., contract for erecting U. S. Post Office, at $244,996.

Cleveland, Ohio—To Crowell-Lundoff-Little Co., contract for Laurel school, 10001 Euclid Ave., estimated cost, $40,000.

Philadelphia, Pa.—To Melody & Keating, 1322 Race St., contract for erecting three-story, 63 by 74-foot, stone and concrete school at Twenty-third and Cambria Sts. Cost, $59,000.

Sarnia, Ont.—To James Schanks, 272 Wellington St., contract for the erection of a school. Approximate cost, $16,000.

Sarnia, Ont.—To The Schultz Co., Brantford, Ont., contract for the construction on new school building. Cost, $58,000.

Sioux City, Iowa—To Ingeman Co., St. Paul, contract for erecting St. Vincent Hospital, on Seventh and James Sts., at $102,000.

CONTEMPLATED WORK.

Columbus, Mo.—Grade school building to cost $35,000 will be erected. Address Secy. Bd. of Educ.

Greenwood, Ark.—Plans being erected for courthouse for Sebastian county. Estimated cost, $60,000. A. Klingensmith, Ft. Smith, Archt.

Lewiston, Pa.—Erection of a Y. M. C. A.

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Contracting News

building contemplated here. Probable cost, $75,000.

Lewiston, Pa.—Construction of high school building to cost $100,000 being considered. T. L. Brooks, Supt. of Schools.

Medford, Mass.—Plans prepared for Junior High School to be erected at Park and Washington Sts. Cost, $185,000. Address Bd. of Educ.

Minot, N. D.—Plans being prepared by W. E. Hulse & Co., Hutchinson, Kan., for high school to be erected here. Cost, $125,000.

Port Arthur, Tex.—The Attorney General approved a $250,000 bond issue for erection of high school.

GARBAGE DISPOSAL.

CONTRACTS AWARDED.

Fargo, N. D.—To Northern Incinerator Co., Minneapolis, Minn., contract for a 10-ton unit incinerator.

CONTEMPLATED WORK.

Bridgeport, Conn.—A 3-story addition of concrete blocks to be constructed to garbage plant at a cost of $50,000.

Brownsville, Tex.—City is in the market for a garbage incinerator with a capacity for burning 1 ton of garbage per hour. Address City Manager.

Port Arthur, Tex.—Construction of garbage incinerator being considered by city. Probable cost, $7,500.

LIGHTING.

CONTRACTS AWARDED.

Glen Falls, N. Y.—To Lamont & Twiss, Glenns Falls, contract for installing the electric fixtures on the new river bridge, bid of $112.50. Forty 100-watt lamps will be installed. To Adirondack Electric Power Corporation, bid of $21.50 per lamp per year.

Pamona, Cumberland—To Paul E. Conner, contract for installing centrifugally cast reinforced concrete posts, wires, conduits, lamps, etc., and for street lighting purposes, lowest bidder of $8,578.73.

CONTEMPLATED WORK.

Whitesburg, Ky.—Plans for establishment of electric light plant being discussed.

MUNICIPAL BONDS.

Boonville, Ind.—July 3, until 10 a. m., for sale, $2,600 highway improvement bonds, 4½ per cent. Wm. H. Putler, treasurer.

Kokomo, Ind.—July 8, until 10 a. m., for sale, $9,000 fire department bonds, 4½ per cent., ten years. Ben Havens, city clerk.

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Brownstown, Ind.—July 3, until 2 p. m., for the improvement of a highway in said county by grading, draining and paving with macadam, estimated cost, $18,205.00. Albert Luedtke, auditor.

Columbus, Ind.—July 5, until 10 a. m., for the construction of a concrete road in Columbus township. W. H. Scott, auditor.

Corydon, Harrison County, Ind.—July 5, until 2 p. m., to furnish all the material and construct a gravel road petitioned for by Benjamin Russell et al., on the line between Raylor & Posey townships, said county. J. L. O'Bannon, auditor Harrison county.

Crawfordsville, Ind.—July 5, until 10 a. m., for the construction of a gravel road in Brown township. Dr. W. F. Batman, auditor.

English, Ind.—July 3, until 2 p. m., for the construction of a road in Patoka township. J. B. Enlow, auditor.

Fowler, Ind.—July 3, until 1 p. m., for the construction of a road in Oak Grove township. Warren Mankey, auditor.

Fulton, Mo.—Until July 6, for approximately 2,000 sq. yds. bituminous macadam and 4,450 lin. ft. concrete curb. F. E. Baker, City Engr.

Franklin, Ind.—July 3, until 2 p. m., for the construction of two gravel roads, one in White River township. Jno. C. Gregg, Aud.

Goshen, Ind.—July 5, until 1:30 p. m., for the construction of a road in Elkhart township, with brick or other paving material. A. R. Bemenderfer, Auditor.

Greensburg, Ind.—July 3, until 1 p. m., for the construction of roads in Fugit and Clinton townships. John C. Barbe, Auditor.

Jeffersonville, Ind.—July 3, until 10 a. m., for the construction of a road in Monroe township. George W. Stoner, Auditor.

Kentland, Ind.—July 3, until 1 p. m., for the construction of three macadam roads in Beaver township, and one macadam road in Jefferson township. S. R. Sizelove, Auditor.

Kokomo, Ind.—July 3, until 10 a. m., for the improvement of the roadway of Walnut St., from the west line Lafountain St., east to the P. C. C. & St. L. railway tracks. Ben Havens, City Clerk.

Kokomo, Ind.—July 5, until 10 a. m., for the construction of two gravel roads, 13,205 and 7,000 feet in length, in Ervin and Union townships. Wm. L. Benson, Auditor

Lake City, Fla.—Until July 5, for 21,000 sq. yds. vitrified brick paving with grout filler or modified sheet asphalt or sheetasphalt and 10,000 lin. ft. concrete curb. C. R. Horne, Lake City.

LaPorte, Ind.—July 6, until 10 a. m., for the construction of a road in Center township and one in Center and Scioto townships. Fred A. Hausheer, Auditor.

Lexington, Miss.—Until July 3, for constructing 27 miles of macadam roads in Durant District. Snowden & Hauser, Engrs. Jackson.

Lebanon, Ind.—July 5, until 10 a. m., for the construction of roads in Washington, Jefferson and Sugar Creek townships. Cleve Goodwin, Auditor.

Mt. Vernon, Ind.—July 7, until 2 p. m., for the construction of 15,710 ft. of gravel road in Marrs township and 14,024 ft. in Harmony township. Joseph R. Haines, Auditor.

Paoli, Ind.—July 3, until 2 p. m., for the construction of a gravel or macadamized road on line between French Lick and Orangeville townships. E.A. Palmer, Auditor.

Peru, Ind.—July 29, until 1 a. m., for the construction of gravel and concrete roads in Peru township. F. M. McElheny, Auditor.

Plymouth, Ind.—July 5, until 2 p. m., for the construction of two roads in North township. Otto H. Weber, Auditor.

Rochester, Ind.—July 5, until 2 p. m., for the construction of five gravel roads in Rochester township and two in Henry township. Ernest A. Smith, Auditor.

Shelbyville, Ind.—July 5, until 10 a. m., for the construction of two gravel roads in Moral township and one in Jackson township, 14,025, 14,900 and 17,400 ft. in length. Frank W. Fagel, Auditor.

Tipton, Ind.—July 3, until 10 a. m., for the construction of gravel roads in Cicero and Madison townships. Oscar Vanness, Auditor.

Valparaiso, Ind.—July 5, until 2 p. m., for the construction of two gravel roads in Westchester township, 0.86 and 1.04 miles in length. C. A. Blackly, Auditor.

Versailles, Ind.—July 3, until 1 p. m., for the construction of macadam roads in Adams, Johnson and Laughery townships. J. Francis Lochard, Auditor.

Vincennes, Ind.—July 5, until 2 p. m., for the construction of 5,040 ft. of gravel road in Johnson township. J. Muentzer, Auditor.

Warsaw, Ind.—July 6, until 10 a. m., for the construction of a gravel road in Scott township. V. D. Mock, Auditor.

CONTRACTS AWARDED.

Akron, Ohio—To S. W. Parshall & Son, contract for paving, sewering and sidewalk work on Main and McCoy Sts., at $37,672.65. To Charles H. Waters, contract for paving on Willard St., at $13,372.

Billings, Mont.—To C. H. Green, Spokane, Wash., contract for 47 miles of macadam roads, 8 and 10 ft. wide, at $167,000. F. E. Williams, County Clerk.

Camden, N. J.—To J. F. Shanley & Co., contract for resurfacing King's Highway, Haddonfield, and Kaighn Ave., at $19,641.87. Address J. F. Shanley & Co., 306 Essex Bldg., Newark, N. J.

Carbondale, Pa.—To Boland Bros., Carbondale, and John Booth, Carbondale, contracts for paving six streets, at $71,227.80.

Charleston, W. Va.—To Central Engineering Co., Charleston, and R. M. Hudson Paving Co., Charleston, contracts for constructing asphaltic concrete and concrete pavements.

Cincinnati, Ohio—To Evan Evans, 1226 Ida St., contract for 13,500 sq. yds. granite paving on Pearl street, at $39,134.

Cohoes, N. Y.—To Langan Construction Corp., Albany, contract for paving with vitrified brick on Lincoln Ave., between Congress and Alexander Sts., at $16,683.30.

East Cleveland, Ohio—To Cleveland Trinidad Paving Co., 420 Lakeside Ave., Cleveland, contracts for paving about 3½ miles of Euclid Ave. with 2-in. asphalt, 1-in. filler and 8-in. concrete base, at $91,755. To Pace Brothers Co., 608 Marshall Bldg., Cleveland, at $83,954.

Fort Collins, Colo.—To G. Fred Roberts Construction Co., Denver, Colo., contract for paving in College Ave. and LaPorte Ave. improvement districts. Includes 1,500 ft. road, 108 ft. wide; 2,500 cu. yds. grading; 1,805 cu: yds. brick pavement; 20,838 sq. yds. 6-inch, 1-course, reinforced concrete pavement, at $22,238.99. F. P. Goeder, City Engineer.

Galion, Ohio—To Brooks Construction Co., Fort Wayne, Ind., contract for 12,000 sq. yds. asphalt pavement, with curb and gutter, and 1,300 cu. yds. grading. Street 3,350 ft. long, 28 ft. wide, at $22,500.

Gary, Ind.—Newkirk & Powers, Joliet, Ill., contract for improving Buchanan St. Will include opening, grading, paving, bridge and subways, at $257,000.

Greencastle, Ind.—To Lisby & Masten, Coatesville, and Sturgeon, Leonard & Co., Russellville, contract for 14,373 ft. macadam road and 5,020 ft. gravel road.

Harrisburg, Ill.—To C. H. Degenhardt, contract for paving various streets with brick, at $130,000.

Hartford, Conn.—To Warren Brothers, Providence, R. I., contract for about $500,000 worth of paving about 40 miles of streets.

Hazelton, Pa.—To the Hassam Paving Co., New York, N. Y., contract for paving Broad St. with bicomac, at $26,944.50. To State Paving Co., Wilkes Barre, Pa., for paving Diamond Ave., with amiesite, at $26,275.84. To John A. Leffler, Hazelton, for paving Laurel Hill road with amiesite, at $6,160.

Hermosa Beach, Cal.—To California-Arizona Construction Co., 1700 E. Washington St., Los Angeles, contract for improving 8th St., at $17,824.15.

Jefferson, Ia.—To the Ford Paving Co., Cedar Rapids, contract for sheet asphalt paving, at $1.80 per sq. yd. for Trinidad Lake asphalt.

Joliet, Ill.—To R. F. Conway & Co., 133 W. Washington St., Chicago, contract for paving W. Cass St. with asphalt, at $1.20 per sq. yd. To the Embankment Co., Joliet, for brick paving on E. Cass and Columbia Sts., at $1.84 and $1.81.

Lebanon, Pa.—To Dwyer & Co., Philadelphia, contract for constructing reinforced cement concrete pavement 3.64 miles long, at $68,533.21.

Monmouth, Ore.—To Hobson & Hoskins, McMinnville, contract for paving and curbing Main St., at $7,917.87.

Ottawa, Ont.—To The Union Construction Co., Ottawa, contract for the Bank St. subway elevated sidewalk and roadway, at $11,046.

Payne, Ohio—To Minnich Construction Co., Newcastle, Ind., contract for paving N. Main Oak and Laura Sts., at $31,200.

Plymouth, Mass.—To E. J. Rourke, N. Abington, contract for constructing a section of state highway, at $12,543.

Princeton, Ill.—To John Cherry, Jacksonville, Ill., contract for paving several miles of streets, at $90,000.

Quincy, Ill.—To Frank Rees, Quincy, contract for paving Broadway with brick, at $21,360.04.

Rochester, Minn.—To Widdell Co., Mankato, Minn., contract for paving N. Broadway for this city. Will consist of 2½-inch tarvia granite top on 5-in. concrete base. Cost, $24,000. J. C. Utton, City Engineer.

Rock Island, Ill.—To J. D. Ryan Co., Davenport, Ia., contract for paving Ninth

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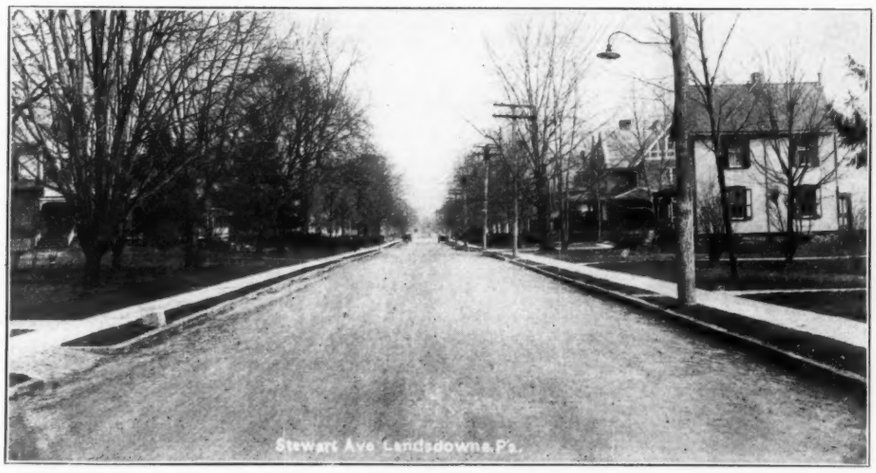

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Contracting News

and Thirteenth Sts. with asphalt, at $46,518.50.

Rushville, Ind.—To A. L. Tribble, Noblesville, contract for constructing the John Kelly, Jr., road, brick and rocmac, at $25,820.

Seattle, Wash.—To Washington Paving Co., L. C. Smith Bldg., contract for surfacing with crushedrock of permanent highways Nos. 9-A and 9-B in Whitman county, at $46,633.

South Pittsburgh, Tenn.—To G. S. Williams & Co., Dayton, Tenn., contract for constructing macadam roads, at $80,911.

Springfield, Ill.—To Reese Bros., Quincy, Ill., contract for building 1½ miles roadway on State St., E., at $15,283.87.

Sterling, Ill.—To Kelly Bros., Morrison, Ill., contract for constructing 2¾ miles of the Lincoln Highway. Work includes 26,803 cu. yds. brick pavement, 18 ft. wide, and 4,852 cu. yds. grading, at $50,960.45.

St. Thomas, Ont.—To A. E. Ponsford, Ltd., contract for the construction of sidewalks, curbs and gutters.

South Bend, Ind.—To W. B. Brady Construction Co., J. M. S. Bldg, contract for paving Mishawaka Ave. with Trinidad Lake asphalt, about 45,443 sq. yds. asphalt, and between car tracks with brick, 25,146 sq. yds., at $146,295.

Tacoma, Wash.—To Henry J. Kaiser, Everett, contract for constructing permanent highway No. 3B, at $95,970.

Toledo, O.—To Peters Bros. & Co., Toledo, contract for paving 4,010 sq. yds. with vitrified brick on 6-in. concrete base, cost $11,650.05.

Wilkes-Barre, Pa.—To the State Paving Co., contract for 36,000 sq. yds. of sheet asphalt paving, at $1.88 per sq. yd.

Wilmington, Del.—To Union Paving Co., Schenectady, N. Y., for paving as follows: Sheet asphalt, $1.62 per sq. yd.; asphalt concrete, $1.67; asphalt block, $2.85; Westport vitrified block, $2.63; Hillside, $3.73; concrete gutters, $1.70; vitrified block gutters, $2.63; vitrified block between trolley rails, $2.80; Hillside, $2.90. Number of days to complete, 70.

Winlock, Wash.—To W. F. Meismer, Seattle, contract for paving 1st St. between Station and Bendict Pl., at $20,965.

Waterloo, N. Y.—To McMahon & Farrington, Binghamton, contract for constructing about 23,000 sq. yds. of reinforced concrete pavement, and 10,000 lin. ft. of concrete curbing, at $44,762.

Wausau, Wis.—To The Conducive Paving Co., of Chicago, contract awarded for street paving at Sterling, Ill. Amounts to $107,503.37.

CONTEMPLATED WORK.

Erwin, Tenn.—An issue of $100,000 road bonds has been voted. Add. the Co. Judge of Unicoi Co.

Hackensack, N. J.—City contemplates expenditure of $40,000 for county road repair work.

Madison, N. J.—The widening of Lincoln Pl. is contemplated. Add. Town Council.

Martinsburg, W. Va.—City contemplates paving West King and East Market Sts. Estimated cost, $150,000. E. D. Bromley, city engr.

Muscatine, Ia.—Between $100,000 and $145,000 will be expended for paving. Add. C. H. Young, city engr.

San Springs, Okla.—Plans are being prepared by The Benham Engineering Co., consulting engineers, for the city. Approximate amount of work contemplated, $60,000.00.

Seattle, Wash.—City council will pave three miles of East Marginal way with brick block and 2,000 ft. with creosote block. Cost $128,000. Add. City Clerk.

Springfield, Ill.—The paving with brick of Miller St., at an estimated cost of $16,586.1- is under consideration.

SEWERS.

BIDS REQUESTED.

Billings, Mont.—Until August 1, for gravel bitulithic bituminous concrete, and asphaltic macadam, lateral storm sewers, gutters, etc. E. M. Sneckenberger, city engr.

Houston, Tex.—July 3, until 10 a. m., for construction of 1,600 ft. of 36-in. sewer on Harrisburg Rd. H. L. Washburn, county auditor.

Jamestown, N. D.—Until July, bids for constructing sewers and sewage disposal plant. Cost $70,000. L. P. Wolff, 100 Germania Life Bldg., St. Paul, Minn., engr.

Mapleton, Iowa.—Until July 15, for sewer system, to cost $30,000. Add. City Clerk.

Plainfield, N. J.—Until July 3, for sewage pumping station, 44,077 ft. 8 to 24-in. vitrified pipe sewer, 4,044 ft. 8 to 16-in. cast iron pipe sewer, 112 manholes, 144 flush tanks. C. C., $1.000. James T. MacMurray, city clerk.

CONTRACTS AWARDED.

Afton, Okla.—To The Municipal Excavator Co. of Oklahoma City, Okla., contract for the construction of sanitary main and lateral sewers, at $23,758.20.

Beloit, Wis.—To Scully & Koontz, 5028 Sunnyside Ave., Chicago, Ill., contract for constructing sewers, at $9,662. Will include 11,152 ft. sewer, 36 manholes, 150 curb sewer services.

Boston, Mass.—To Anthony Gofalo, 316 Belgrade Ave., contract for sewers in Perham St., at $11,738.

Boston, Mass.—To Roy H. Beatie, Inc., Fall River, Mass., contract for extending outfall sewers at Deer Island, Boston harbor, at $39,838.

Biddeford, Me.—To F. A. Rumery Co., Portland, contract for constructing main sewer in Summer St., at $16,623.

Cincinnati, O.—To John B. McLane Co., 520 East Fourth, Cincinnati, contract for constructing sewers in Hyde Park S. subdivision, at $36,000.

Dayton, O.—To J. H. Cahill, of Louisville, Ky., contract for the construction of the storm sewer, along what is known as Dry Hollow creek, lowest bid for $97,198.69.

Durham, N. C.—To Obenshain Construction Corporation, Roanoke, Va., contract for constructing 6½ miles 24-in. sewer, at $25,961.60.

East Palestine, O.—To Consolidated Engineering Co., 243 Calvert Bldg., Baltimore, Md., contract for 15 miles of sewers. Est. cost, $150,000.

Fargo, N. D.—To Haggerty Construction Co., contract for laying mains, at $12,000.

Lindsborg, Kan.—To Glidden & Hobbs, Lawrence, Kan., contract for vitrified pipe sewers and curb and gutter work, at $14,753.

Marshall, Ill.—To Oliver & Wheeler, LeRoy, Ill., contract for nine blocks combined sanitary and storm water sewers.

Marengo, Ia.—To C. G. Herrick Co., Des Moines, contract for sewer system, at $48,453.

Myrtle Point, Ore.—To Edward Sandeberg, Portland, Ore., contract for constructing sewers, at $14,536.75.

New York, N. Y.—To J. C. Rogers, Jr., contract for constructing alteration improvements to sewers in 151st St., to Casparini & Deblasio for Park Ave., to Joseph J. Haiduvin for receiving basins in 11th Ave.

New York, N. Y.—To Louis D. Gregory, 212 W. 138th St., Manhattan, New York, N. Y., contract for constructing water mains and appurtenances in various streets.

Newcomerstown, O.—To Shullo Bros., Pittman, contract for constructing sewer system, at $38,032.

Milwaukee, Wis.—To John F. Casey Co., Pittsburgh, Pa., contract for intercepting sewer on west side of Milwaukee river, at $470,441.

Pontiac, Ill.—To E. Sherman Baer Co., Streator, Ill., contract for the construction of sewage disposal plant, at $18,538.

Three Forks, Mont.—To Security Bridge Co., of Spokane, Wash., contract for laying mains, at $76,850.

Tiffin, O.—To Martin Schauder, Clay St., Tiffin, O., contract for constructing sewers, 1,762 ft. long, at $1,243.97.

WATER WORKS.

BIDS REQUESTED.

Washington, D. C.—Until July 10, for the furnishing of 297 tons of cast-iron pipe and 50 tons of specials. Add. Purchasing Officer, District Bldg.

CONTRACTS AWARDED.

Alliance, Neb.—To Nebraska Construction Co., of Lincoln, contract for constructing a new reservoir.

Ashton, Neb.—To Nebraska Construction Co., Lincoln, contract for constructing water works system, at $10,061.

Blairstown, Ia.—To C. W. Roland Co., Des Moines, Ia., contract for water works system, at $13,175.

Boston, Mass.—To Thos. Burke, 5 Leyland St., Dorchester, Mass., contract for constructing water pipes in various streets, at $14,305.

Brocton, N. Y.—To Shipman, Lincoln & Welch, Bank Bldg., Gowanda, contract for extending water system, at $18,[illegible] W. McCulloh, Gluck Bldg., Niagara

Dixon, Ill.—To Myers Const. St. Louis, Mo., contract for e[illegible] water supply system at State Colony, a. $25,630.

Farmersville, O.—To Geo. A. Harrop, South Bend, Ind., contract for completing the water works system, including 4-in. 6-in. and 8-in. pipe, valves, hydrants, pumps, and elevated tank of 50,000 gal. capacity, at $13,038.

Hailey, Ida.—To Utah Constr. Co., Salt Lake City, Utah, contract for constructing water storage reservoir on Fish creek for Pacific Water & Colonizing Co., at about $75,000.

Ironton, O.—To the Merydeth Construction Co., contract for constructing reservoir for water works system, Marietta, Ohio, at $79,617.

Ironton, O.—To The New York, Continental Jewell Filtration Co., contract for installing a filtration plant, at $103,357.

Maywood, Ill.—To R. C. Wood & Co., 14 East Jackson Blvd., Chicago, contract for 900,000-gal. concrete storage reservoir and laying pipe and connections.

Memphis, Tenn.—To Koehler Bros., contract for constructing reservoir No. 2, at $28,371. To Fowler Construction Co., for reservoir No. 3, at $25,633. To A. DeFranceschi, for reservoir No. 4, in connection with North Memphis levee project, at $11,547.

Perry, N. Y.—To Dessiderio & Sattler, of Rochester, for the filtration plant for water system, at $21,196.74. Plant will be built on east side of Silver Lake.

Pleasantville, Ia.—To C. W. Roland & Co., of Des Moines, Ia., contract for installing a water works system, including all works but the drilling of a well, at $16,750.

Rock Island, Ill.—To P. V. Trenkenachuk, Rock Island, contract for laying water mains in Twenty-ninth Ave. Will require 6,570 ft. 10-in. pipe, 22 hydrants, etc., at $16,787.

Troup, Tex.—To First National Bank of Troup, contract for construction of municipal water works. Includes 1,000-ft. dam, 8, 6 and 4-in. pipes, tank, motors, etc. R. G. Storey, city attorney.

Welsh, Okla.—To McIntosh Walton Co., Oklahoma, contract for constructing water works, at $22,000. S. M. Beston, city clerk.